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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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2 APRIL 1987

USSR REPORT

Cybernetics, Computers and Automation Technology

Contents

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USE OF PROTOTYPE PROGRAMS IN MODIFICATION OF ASU SOFTWARE

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 39-41

[Article by Engineer S. V. Yakovlev]

[Text] Data processing in an automated management system should support a specific level of reliability so that the resulting data of computations be reliable, of high quality and so that they can be presented within the planned deadline. Rigid time restrictions for timely correction of errors in software (PO) are necessary in data processing in this regard.

The programmer's reaction time to an error should be rather short, since otherwise the planned deadline of computing a task is disrupted and trust in the IVTs [Information Computer Center] is lost on the part of plant services and plant management.

Systematic modification of programs during operation of the system results in the fact that essentially all programs are modified. Since each programmer introduces his own programming style in the fragment of software to be modified, each subsequent programmer must comprehend the coding characteristics of both the program author and of all the predecessor programmers. It is obvious that this is not a simple task and requires good skills. However, the more interesting work usually attracts highly skilled personnel to design organizations. Therefore, programming aids must be developed that permit the maintenance programmer to form his job within established deadlines with a guarantee of software quality, regardless of his skills.

The existing aids for software development (RTK, PRIZ, MARS, SPORA, APROP, YaUZA and so on) are oriented toward the skilled programmer and are designed for the production of large programming complexes; therefore, they are very rarely used in plant information computer centers.

The lack of a method for making modifications in software gradually reduces its quality (speed is reduced, the main memory capacity is increased and the recognizability of programs deteriorates), which in turn delays the increase of savings from introduction of the automated management system even under conditions of constant and specific improvement. According to the estimates of leading specialists, program maintenance of software is the most important

phase in the life cycle of programs and requires up to 80 percent of the total expenditures for programming. (Footnote 1) (R. Glass and R. Hause, "Soprovozhdeniye programmnogo obespechniya" [Software Maintenance], translated from English, Moscow Izdatelstvo "Mir", 1983, 158 pages)

Modification of software can conditionally be divided by the scale of changes into functional and operator modification: functional modification is achieved at the level of individual functions, which provide for removal, supplementation, replacement and changing of the sequence of executing the functional modules. A new sequence of modules, combined by one or several control modules, is sometimes added to existing software. This modification is in fact development, but its scales are limited.

The effectiveness of functional modification depends on the extent to which the software can be broken down into modules during initial development. Operator modification is performed within an individual functional module, while correction concerns individual operators or a sequence of them. The simplicity of modification in operator modification is dependent on the architecture of each program module individually.

However, the modular nature of software alone and the use of structured programming procedures in working out programs cannot guarantee speed in modification of them, since different programmers, each in his own way, interpret the situations of these fundamental concepts, while the final product of their activity reflects to a significant degree the individuality of the developer. Additional methodical propositions, software and organizational media are required to implement effective maintenance. The experience of software maintenance of automated management systems indicates that methods of implementing this task should meet the following conditions: maximum orientation toward the stereotype nature of modules, the capability of using production procedures of programming both in working out the new programs and in maintenance and guaranteed recognizability of the programs regardless of the personal characteristics of the programming style.

Regularity in programming is very important and real programs should be represented by stereotype (frequently repeated) fragments. Analyzing the structure of the stereotype fragment, one can determine its components, i.e., other subordinate stereotype fragments, and one can identify them for determination of the roles which the components should play with respect to the initial situation.

A simple and rather expressive form of implementing the programs of automated management systems is to work out and modify them on the basis of semifinished-blank programs. These blanks, so-called program-prototypes (PP), are the basis for future program modules.

The prototype program is a module that implements earlier determined functional processing of information and which permits step-by-step descending development of the program by disclosure and detailing of bottlenecks. This approach concentrates attention toward a partially completed program and permits one to investigate more fully the software fragments. If the program module is implemented on the basis of a prototype program, modification of it reduces to

modification of individual fragments and these fragments are not difficult to determine, and by taking into account the independence of procedures that implement these fragments, one can make changes in phases and independently one from another.

It is recommended that the existing operators of the initial text reconfigure the programs to prototype program procedures and then make the modification only when modifying already existing software, implemented without the use of prototype programs. Universal liberation of elementary, repeating fragments of programs is the main thing, which may improve the working efficiency of programmers.

The prototype program is a means of recording the experience of previous work in programming. The infrequent programmer writes the program, being guided only by postulation of the task. The design elements of programs, already checked in practice by the programmer himself, are usually employed actively in programming. If personal experience is insufficient, the structures of programs that implement similar algorithms written by his colleagues are analyzed and borrowed.

In making a decision in a specific situation, the programmer compares this situation to his own experience, analyzes it and selects the method of actions, which were successful in the past. The experience of previous developments is implemented in the prototype programs. Many data processing situations were taken into account in the same manner, which considerably reduces the information load of both the program developer and of the attendent programmer. Everything that is subject to formalization in the data processing algorithms should be reflected in the designs of prototype programs.

Analysis of the ASU software made it possible to determine that 80 percent of the functional modules can be related to different groups of programs, having similar design (within the group), for which development of the prototype program is possible. The basis of this grouping of ASU software is determination of the main operations on data sets, i.e., selection, compression and joint processing of files, printing and sorting. Each of these basic operations are primarily divided into operations with narrower specialization. For example, detailing the access operations permits one to determine the following versions (Footnote) (V. M. Gluskov, A. V. Gladun, L. S. Lozinskiy et al., "Obrabotka informatsionnykh massivov v avtomatizirovannykh sistemakh upravleniya" [Processing Data Files in Automated Management Systems], Kiev, Izdatelstvo "Naukova dumka", 1970, 217 pages):

> group access, reduction of data set, selection, access of extreme records, analysis of data set, reconfiguration and computation version.

The prototype programs are worked out for each determined operation on data sets and for frequently used program designs. The complexity of the program module is determined mainly by the set of route-paths, according to which control is transferred upon fulfillment of the module. The routes and processing fragments, typical for each specific type of module, are determined by using decision tables. (Footnote) (E. Jodan [Yourdan], "Strukturnoye proyektirovaniye i konstruirovaniye programm" [Structural Design and Program Design], translated

Условия (1)	(2)Допустимые комбинации								
	1	2	3	4	5	6	7	8	9
Конец файла *A* (3)	0	0	0	0	0	0	1	1	1
Конец файла *B* (4)	0	0	0	1	1	1	0	1	1
Значение ключа файла: (5)									
А меньше, чем файла В (6)	0	0	1	0	0	1	0	0	0
А больше, чем файла В (7)	0	1	0	0	1	0	1	0	1
Значения ключей файлов *A* и *B* равны (8)		0	0	1	0	0	0	1	0
Действия (9)									
Обработка ситуации: (10)									
«есть запись файла *A* и нет записи файла *B*» (11)			×			×			
«есть запись файла *B* и нет записи файла *A*» (12)		V			V		V		V
«есть записи обоих файлов» (13)	×			×					
Чтение записи файла *A* (14)	×		×	×		×			
Формирование таблицы записей файла *B* (15)		×					×		
Признак равенства ключей (16)	1	0	0	1		0	0		
Завершение работы (17)								×	

Figure 1. Converted Decision Table of SOMDAV Prototype Program

Key:

1. Conditions
2. Permissible combinations
3. End of file A
4. End of file B
5. Value of file key
6. A less than file B
7. A greater than file B
8. Values of keys of files A and BV are equal
9. Values of keys of files A and B are equal

9. Actions
10. Processing situation
11. Record of file A and no record of file B
12. Record of file B and no record of file A
13. Records of both files
14. Read record of file A
15. Formulation of table of records of file B
16. Feature of equality of keys
17. Completion of work

from English, edited by L. N. Korolev, Moscow, Izdatelstvo "Mir", 1979, 416 pages) A converted decision table for joint processing of two data sets--A and B, in each of which there are records with identical values of comparision keys, is presented in Figure 1. The records of data set B with identical keys are entered in the main memory table, while records of data set A are read and processed with the table. Processing the ends of files reduces to an ordinary working diagram, the maximum possible value is assigned to the comparison keys. Five conditions at the input are analyzed to formulate the complete decision table and there is a total (possible) of $2^5 = 32$ combinations. But only five of them are acceptable and the remainder are rejected due to contradiction. The operation of the prototype program can be represented by a graph with nine vertices (according to the number of possible states), while the graph itself is described by an adjacency matrix measuring 9 x 9 in Figure 2. (Footnote) (V. V. Lipayev, "Kachestvo programmnogo obespecheniya" [Software Quality], Moscow, Izdatelstvo "Finansy i statistika", 1983, 263 pages) The one is located in position $\dot{I}$, $\dot{J}$ in this matrix, if one can convert from vertex $\dot{I}$ to vertex $\dot{J}$ within one step. Otherwise, a zero is placed in the position of the matrix. Based on analysis of the decision table and of the adjacency matrix, a

design of a prototype program for joint processing of files with duplicating keys A and B (SOMDAV) is worked out, in which 26 various transitions from one state to another is implemented, with a total number of operators of initial text of the prototype program in PL/1 language is equal to 101. The designs of the remaining prototype programs were worked out in similar fashion.

Результирующее состояние (1)

(2) Исходное состояние

	1	2	3	4	5	6	7	8	9
1	1	1	0	0	0	0	1	0	0
2	1	1	1	1	1	1	0	0	0
3	1	1	1	0	0	0	1	0	0
4	0	0	0	1	1	0	0	0	1
5	0	0	0	0	0	1	0	0	0
6	0	0	0	1	1	1	0	1	1
7	0	0	0	0	0	0	1	0	1
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	1	0

Figure 2. Adjacency Matrix of States

Key:
1. Resulting state
2. Initial state

The following were worked out to automate the programming operations: prototype program generator, text editor and program complex for issue of normalized jobs on basis of prototype program and for computation of quantative indicators of the working efficiency of programmers.

The experience of using prototype programs in modification of ASU software demonstrated their high efficiency: the labor productivity of programmers increased and the deadlines for completion of programming work were reduced by a factor of 4-5 compared to typical time norms. (Footnote) ("Tipovyye normy vremeni na programmirovaniye zadach dlya EVM" [Typical Time Standards for Computer Programming Tasks], Moscow, Gosudarstvenny, komitet SSSR po trudu i sotsialnym voprosam, 1981, 28 pages) Modification of the software was simplified considerably, while design of the programs reduces the volume of program documentation by factor of 2-3. A total of four exercises of two hours each is sufficient to assimilate the prototype program in the activity of medium-skilled programmers.

6521
CSO: 1863/34

AUTOMATED SYSTEM OF INTEGRATED DATA PROCESSING FOR THE 'ISKRA-226'

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by N. Gorelik, candidate of technical sciences, V. Grinshteyn, and A. Finogenov: "To Each By Strength"; under the rubric: "The Computer and Us"; first paragraph in italics in source; second paragraph in boldface]

[Text] The SoyuzmorNIIproekt [State Planning, Design, and Scientific-Research Institute of Marine Transportation, Soviet Ministry of the Maritime Fleet] specialists, developers of the "Morflot" ASU [Automated Control System] consider that in creating a program, it is necessary to take the user's level of preparation into account.

Almost every day the mail brings news resembling military operations summaries from the site of events. The process of computerization is proceeding in the country on a wide front. Understandably, this raises no small number of questions and issues: How to more quickly master programming basics; is it possible to make interaction with a computer even more accessible and the study of computers more vivid? These are only some of the questions raised by "NTR" readers. Thus, the reader shares experience, proposes solutions...

The problem of the "computer user" is not a new one. Paradoxical as it may be, frequently some person does not want to become a "user." One reason for such behavior is fear or an aversion to relearning or mastering a complex contemporary technology.

In order to satisfy the person who has independently gone to a computer for help, it is necessary to know his peculiarities. We have theoretically divided a whole spectrum of users into three types. The first is purely a consumer. His attitude toward a computer is similar to his attitude to everyday technology. He would like to perform simple manipulations, similar to turning a television on or changing the channel, and obtain the required information. The second type of user can be compared with a design engineer. To obtain the results he needs he is prepared to create the corresponding program made up of prepared building blocks, as is done in a child's nursery. Finally, the third user type is a programmer who needs a selection of procedure options which correspond to his qualification level to create the necessary program modifications quickly.

A program can be oriented toward any defined consumer type. But it is better if the program satisfies the requirements of all types and can present all the new alternatives as the growth of qualification and requirements allows. This latter alternative can be demonstrated with the example of an automated system of integrated data processing (ASIOD) developed by the authors for the domestic personal computer "Iskra-226."

Within the limits of the system the "pure consumer" can obtain required information as a result of interactive access in a form that is customary and usual for each person. If requirements increase in number of interaction with the computer, then the person makes the transition to the "design engineer" category of software. It should be noted, however, that such a division is very arbitrary.

A user of this type can construct a form for himself in which he would like to obtain information, for example, a table, or a report, or a document with confirming signature, and so on. For this, it is sufficient to "draw" this form on the screen, using characters present on the terminal keyboard. In just this way he can create a convenient form for data entry into his data base or construct a new data base generally "from scratch." To do this he must, in an interactive session with the computer, respond to questions and carry out all steps of such a construction: giving the list of variables about which he needs information, describing these variables, defining their type (date, numerical information, name, and so on) and dimension, and drawing the input and output information forms. After filling the data base with information he can perform searches and correct mistakes using special programs.

The "design engineers" are a more widespread category of specialists. They must be proprietors of information and their own computer. Therefore they must solve questions of a general character: the processing technology, the path of information retrieval and the provision for its reliability and update. The system makes these alternatives available.

A special automatic mode in ASIOD provides for creating new data bases in place of obsolete ones and allows information to be "pumped across" from the old data base into the new one.

Finally, the programmer, classified by us as the third type of user, can independently write his own program and include it in the system package.

By this means the system can, at any time, turn that facet to the user which he needs at a given moment. It does not require any preliminary preparation from him. He can begin to do more complex work himself of his own accord.

12982/13046
CSO: 1863/68

UDC 669.162.221.2;66.012

MICROPROCESSOR FOR CONTROLLING MOVEMENT OF OXYGEN TUYERE

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 19-20

[Article by Candidate of Technical Sciences A. N. Neretin and Candidate of Technical Sciences V. I. Sherstnev]

[Text] The problem of managing the steel process using scientific methods of control is of special significance in converter steel production, in which the time expended for smelting is reduced, the consumption of materials and energy resources is reduced and the periods of production equipment between repair is increased.

To solve this problem, a microprocessor MPU for controlling the movement of a tuyere was developed at the Lipetsk Branch of the Special Design Office, Scientific Production Association Chermetavtomatika and was introduced at the Novolipetsk Metallurgical Combine imeni Yu. V. Andropov. The microprocessor was based on the LIUS-2 hardware complex (KTS).

A block diagram of controlling the motion of the tuyere is presented in Figure 1.

A point located 150 cm below the electromechanical stop EMU, is adopted as the reference point TO with respect to which the production elevations are fixed. The tuyere F of converter K is fixed in the extreme upper position KVP by the terminal switch KVV and in the extreme lower position KNP by the lower terminal switch KVN. The stroke of the tuyere is 1,811 cm, ΔH is correction of the position of the tuyere, its size is in the range of 100-150 cm and is taken into account when formulating the controls for moving the tuyere. Oxygen is delivered through cutoff valve K31 and is delivered to the tuyere by cutoff valve K32.

According to the production process for smelting steel, the tuyere is moved in the following manner. One of the extreme top position switches is lowered at a rate of 0.2 m/s to the initial position (IP) and is then moved at a rate of 0.734 m/s to the blasting zone. When the tuyere reaches production elevation OPS1, the shutoff valve K32 is switched on (oxygen is delivered to the tuyere) and the rate of its movement is reduced to 0.2 m/s. Upon further movement of the tuyere, the rate is switched from 0.2 to 0.05 m/s at production elevation

OPS2 and it is lowered at this rate into the molten steel bath. As the blasting time assigned by the steel smelting technology passes, the tuyere is raised at a rate of 0.2 m/s. When the tuyer reaches production elevation OPS3, the rate of its motion is switched from 0.2 to 0.5 m/s and shutoff valve K32 is closed. The oxygen remaining in the tuyere and in the connection hose continues to the converter. The tuyere moves upward to elevation IP at a rate of 0.734 m/s from production elevation OPS4.

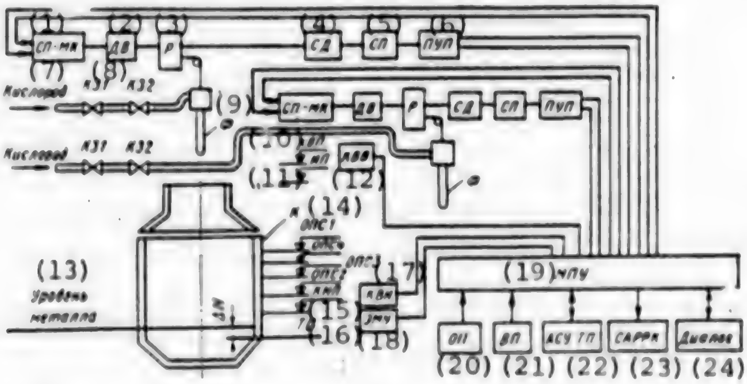

Figure 1. Block Diagram for Controlling Movement of Oxygen Tuyere

Key:

1. Drive system with converter mechanisms
2. Motor
3. Reduction gear
4. Selsyn-sensor
5. Selsyn-receiver
6. Angular displacement converter
7. Oxygen
8. Valve
9. Tuyere
10. Extreme upper position
11. Initial position
12. Terminal switch
13. Metal level
14. Production elevation
15. Extreme lower position
16. TO reference point
17. Lower terminal switch
18. Electromechanical stop
19. Microprocessor
20. Main console
21. Auxiliary console
22. Automated production process management system
23. Automated oxygen flow rate regulation system
24. Interaction

Commands to control the movement of the tuyere are transmitted from the microprocessor to the drive system with SP-MK converter mechanisms and are processed by motor DV, which moves the tuyere through reduction gear R. A selsyn-sensor SD and a selsyn-receiver SP, the shaft of which is rigidly connected to the angular displacement converter PUP, are used to determine the position of the tuyere.

The main console OP is designed to enter and display the tuyere control data, to exchange data with the upper-level automatic control system, to assign correction and current position of the tuyere and also to assign the operating modes of the microprocessor.

The auxiliary console VP is used to enter the production elevations, the numbers of the program for moving the tuyere, the number of the degree of oxygen flow rate, for assigning the oxygen flow rate, the time of oxygen blasting of the steel, for the position of the tuyere and for display of input data.

The microprocessor exchanges information with the automatic oxygen flow-rate regulation system SARRK, the automated steel-smelting production process management system--ASU TP steel-smelting--and the Dialogue system within the automated production process management system, which implements the interaction functions with the technician-operator.

Development of the microprocessor resulted in the need to solve the following combination of problems: to investigate more extensively the steel-smelting process to establish the effect of the parameters of moving the tuyere (rate of motion and position of the tuyere) on the quality of smelting, to work out on the basis of the indicated investigations an adequate mathematical model of the blasing process and to work out on the basis of the mathematical model effective and reliable algorithms and programs for controlling the movement of the tuyere, which permit one to take into account in the best manner the production situations that occur.

The microprocessor provides control in the "Manual," "Automatic" and "Control computer" modes. The position of the tuyere is monitored and displayed in the "Manual" mode. Using the "Automatic" mode, the technician-operator dials the number of the program for moving the tuyere and gives the command to process any of eight programs written in the microprocessor memory. Each of the programs includes up to ten steps of oxygen flow rate. The time of converting to the next step or the amount of oxygen, upon depletion of which one must go to the next step, is indicated in the program. The automatic oxygen consumption regulation system process the given step of oxygen consumption. In the "Control computer" mode, the microprocessor works out the settings for the position of the tuyere, coming from the automated steel-smelting production process management system.

When operating in the "Automatic" and "Control computer" modes, the technician-operator is able to correct the position of the tuyere by transmitting a command from the main console. The tuyere moves in this case at a speed of 0.05 m/s upward or downward until the technician-operator changes his instruction. The position of the tuyere is displayed in these modes.

The microprocessor performs the following functions: "monitoring the position of the tuyere," which measures the position of the tuyere with respect to the reference point with absolute error of ±2.5 cm. The system generates a correction all when the tuyere reaches the extreme upper position and extreme lower position elevations and transmits diagnostic messages of a malfunction of the measuring channel, "display of tuyere's position" displays on a digital board the current position of the tuyere and the frequency of operation is second, "selection of program for moving tuyere during blasting" permits the technician-operator to select one of eight possible programs, "correction of program for moving tuyere during blasting" operates on technical-operator's instructions, "moving tuyere with required speeds" switches the speed of the

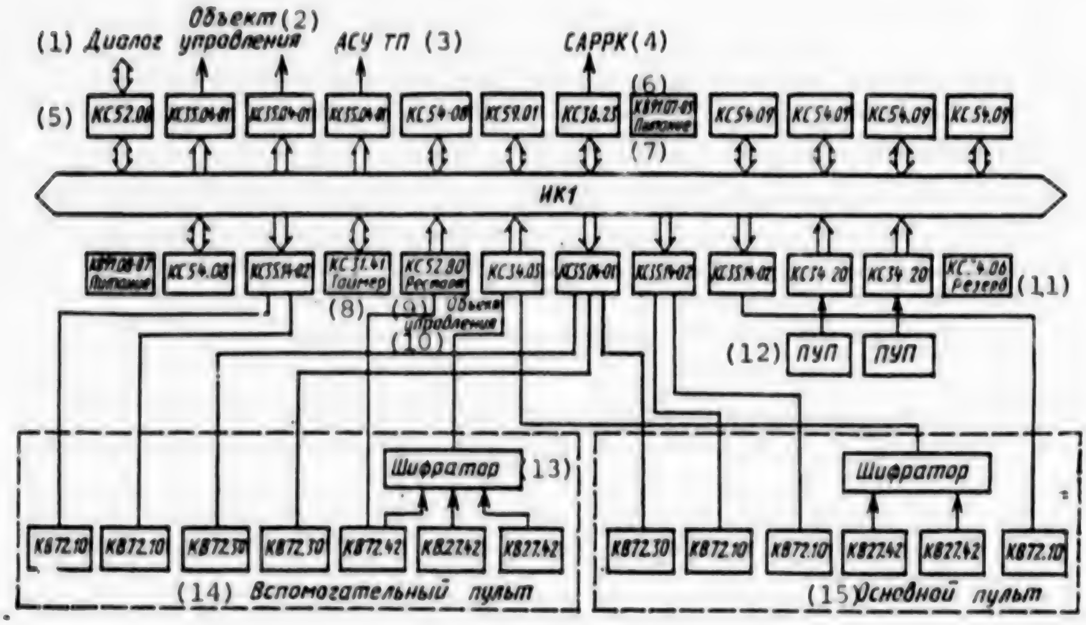

Figure 2. Block Diagram of Hardware of Microprocessor for Controlling Movement of Oxygen Tuyere Based on LIUS-2 Hardware: KS 52.06--linear bit-parallel controller; KS 35.04-01--digital signal output modules; KS 54.08--energy-dependent main memory element; KS 59.01--control element; KS 36.23--alphanumeric display integration modules; KV 91.07-05--interface power supply; KS 54.09--main memory element; KV 91.08.07--noninterface power supply; KS 35.14-02--digital display control module; KS 31.41--timer; KS 52.80--bus access controller; KS 34.03--initiative digital signal input module; KS 34.20--pulse signal input module; KS 34.06--digital signal input module; KV 72.10--digital display module; KV 72.30--signal module; KV 27.42--digital signal control modules; IK1--asynchronous parallel interface; Dialogue--system which implements interaction functions with technician-operator; ASU TP--automated steel-smelting production process management system; SARRK--automatic oxygen consumption regulation system; PUP--angular displacement converter

Key:

1. Dialogue
2. Control facility
3. Automated production process management system
4. Automatic oxygen consumption regulation system
5. KS
6. KV
7. Power supply
8. timer
9. Restart
10. Control facility
11. Standby
12. Angular displacement converter
13. Encoder
14. Auxiliary console
15. Main console

tuyere according to the given program. The tuyere is moved in the "Manual" mode with display of its position, it is moved in the "automatic mode according to the assigned program and the position of the tuyere varies in the "Control computer" mode according to the settings transmitted from the automated steel-smelting production process management system. "Display by control station" signals of oxygen consumption upon conversion to next step and also of the position of the tuyere at this step. "assigning correction of tuyere's position" is worked out from instructions from the main console, "data exchange" transmits data to the automated steel-smelting production process management system about the current position of the tuyere, transmits information about correction of the tuyere's position, about the number of the tuyere, about the operating mode of the microprocessor, about failure of the microprocessor, about reception of the given position of the tuyere, about transmission of authorization to the automatic oxygen consumption regulation system to open (close) shutoff valve K32 and about reception of the signal to raise the tuyere upon completion of blasting.

A block diagram of the microprocessor hardware based on the LIUS-2 hardware is presented in Figure 2. The configuration of the complex provides multiprogram control of the movement of the tuyere, two-way joint data exchange with the automatic oxygen consumption regulation system, the automated steel- smelting process management system and the "Dialogue" system and operation in the continuous 24-hour mode. The selected configuration eliminates data loss if the power supply deviates and provides interchangability of hardware of the same type without any changes or regulations.

The efficiency of the microprocessor can be determined as part of the total efficiency achieved due to use of automated steel-smelting production process management system. The technical and economic indicators of converter production due to introduction of the automated steel-smelting production process management system is improved due to reduction of the additional tipping of the converter and of preblasing, due to increasing the stability of the converter lining, due to reduction of ferroalloy consumption, oxygen consumption and energy resource consumption and due to a decrease of wear of the production equipment. The microprocessor executes two of 25 functions within the automated steel-smelting production process management system: programmed movement of the tuyere during blasting and working out the settings for the position of the tuyere. The approximate annual saving is 150 thousand rubles.

6521
CSO: 1863/34

STRUCTURAL-SYSTEMS ANALYSIS AS A BASIS FOR INCREASING EFFECTIVENESS OF SCIENTIFIC AND TECHNICAL INFORMATION NETWORKS

Baku NARODNOYE KHOZYAYSTVO AZERBAYDZHANA in Russian No 8, Aug 86 pp 39-44

[Article by D.M. Mekhtiyev, T.A. Ibragimov, R.K. Arakelov, Azerb Scientific Research Institute of Scientific and Technical Information]

[Abstract] It has become obvious that without significant technological improvement, the State Automated Scientific and Technical Information System GASNTI) cannot significantly improve its productivity or decrease costs. New, more progressive technologies are required, based on specialization and cooperation of scientific and technical information organizations and maximum utilization of joint resources. This has been achieved by introducing the network principle of functioning of the State Scientific and Technical Information Network. Specialists of the authors' institute have undertaken a computerized analysis of the structure of information requests of the State Scientific and Technical Information System in Azerbayjan, Armenia and Georgia. It was determined that many of the requests for information in each republic were on subjects better handled by the information services of the other republics. Combining the three republic scientific and technical information systems into one, with each handling requests for information in the subject area most familiar to it, could theoretically speed and improve the quality of information responses, while saving tens of thousands of rubles. The first experiments on practical implementation of this process have been begun.

6508/13046
CSO: 1863/133

UDC 62-525

AUTOMATIC MEMORIES - THEIR CHARACTERISTICS AND APPLICATION IN AUTOMATED PRODUCTION PROCESS MANAGEMENT SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 22-24

[Article by Candidate of Technical Sciences Yu. N. Potepalov and Engineer T. A. Neumoyna]

[Text] The basic directions for using memories are as follows: storage of different mode parameters (their programs) in multibrand product output with subsequent transmission of data to control cells, storage of process parameters in the control cells (regulators, programmers and so on) and storage of variable values of the production process (sensor signals) for subsequent automation of economic analysis of production work.

Besides these main functions, memories also execute other auxiliary functions, for example, storage of signals upon sequential transmission of them through a common bus.

The basis indicators of memories are data capacity (for example, in decimal bits) and also the write, storage and playback time. The overall dimensions of the design are also significant.

The following production processes are examined to determine the approximate values of the indicators required for efficient operation of the control systems: production of reinforced concrete products, dyeing spools of yarn and fabrication of "SEARCH" pneumatic integrated circuits.

Partial variation of the programs is typical for all of them, namely: changing the brand of concrete--once per minute, changing the shapes of the reinforced concrete products--once per hour, preparation of dye--once per day and punching one layer of the SEARCH integrated circuits--once per hour.

The short length of the cycle is related either to high performance of the equipment (concrete mixer, programmed stamping) or to its large numbers (30 dyeing units, 10-20 vibrating platforms for the reinforced concrete product molds). These processes are also characterized by tens or hundreds (in the case of dyeing) of operating programs and each program contains up to 10 parameters, which must be controlled with accuracy up to 1 percent. Thus, the total memory capacity is estimated in the range of 100-10,000 decimal bits.

Beside programming tasks, economic indicators (percent fulfillment of the plan, consumption of materials and energy, number of fabricated products) must be calculated in the automated control system. To do this, the readings of the sensors or the calculated current values of indicators should be stored periodically.

The indicators should correspond to the nomenclature of the production subdivisions (for example, three teams at the reinforced concrete products plant and the shop as a whole). Moreover, the accounting periods for the work of the collectives (shift, days, month) should be accounted for. The word length of such indicators as materials consumption and volume of manufactured concrete reaches 6-8 decimal bits. The corresponding calculations make it possible to estimate the memory capacity of economic indicators up to 100 decimal bits.

The requirements on the memories under consideration are determined by designation of the stored data.

The centralized program memory is characterized by the write time (unessential), storage time (without limit, including that when the power is switched off), playback time (within several seconds, bearing in mind the frequency of access to the memory--once per minute) and requirements on overall dimensions (unessential).

The memory in local control cells should meet the following requirements: write time--less than one second, storage time--from several minutes (in cyclic production) to several days (in continuous production), playback time--less than one second; requirements on overall dimensions are more rigid with regard to the larger number of cells.

Economic indicators should be stored with the following parameters: write time--less than one second, storage time--without limit and with the power switched off and playback time--less than ten seconds; the requirements on overall dimensions are unessential with regard to the relatively small memory capacity.

It is obvious from comparison of the physical technical parameters of different memory cells (see table) that there is no best design for all the indicators at once.

Therefore, the memories for automated production process management systems are selected as a function of selection of the parameter (or parameters), the value of which must correspond to the requirements on it.

The memories are divided by designation into three groups, for each of which the most effective type of memory, characterized by the main parameter, is selected.

The memory storage time is selected as the main parameter for centralized program storage.

(1) Ячейки памяти	(2) Код	(3) Габариты, см³	(4) Габариты на 1бит информации	(5) Энергопотребление		(8) Время			(12) Уровни сигналов управления, МПа		(14) Минимальное давление питания, МПа
				(6) емкостное, Дж	(7) мощностное, Вт	(9) памяти, мин	(10) воспроизведения, с	(11) записи, с	(13) входа	(14) выхода	
Триггер: (16) на УСЭППА (17)	(18) Двоичный	41	41	4,56	—	(19) Пока существует питание	(20) Не существенно*	0.2	0; 083	0,14	0.08
на НЭМП (21)	То же (18)	18	18	4,66	4	(19) То же	(20) То же	0.2	0.03	0,14	0.035
на ПОИСК (22)		17	17	—	4	»	»	0.2	0.07	0,112	0.06
Емкостная память (23) на УСЭППА	» (24) Десятичный	105	105 30	—	—	932 68.9	»	0.2	0,063	0,14	(31) Любое
Емкостная память на (25) НЭМП	Двоичный Десятичный	36	36 9	—	4,9	971.3 68.9	»	0.2	0,016	0,11	(31) То же
Пневмотумблер УСЭППА (26)	Двоичный	35	35	(27) Очень мало	(28) Непрерывного расхода нет	(29) Неограничено	»	0.1—1	(30) Не пневматический	—	»
Цифровые задатчики (переключатели) (32)	Десятичный	23	7	То же (27)	То же (28)	То же (29)	»	2—5	—	—	»
Память на носителях (перфолента) (33)	Двоичный	115***	8×10-*****	»	8	»	**	(34) Осуществлена вне АСУ	—	0,01	(35) Зависит от усилителя
Память на носителях (магнитная лента) (36)	Двоичный	470	470	»	2	»	**	То же	—	0,001	То же
Задатчик (37) УСЭППА	Десятичный Аналоговый	22	6,5 3,2	»	1,5	»	(20) Не существенно	1ᶜ—20	—	0,02—0,1	0.126 0.126
Емкостная память на (25) НЭМП	Аналоговый (38)	36	51	4.66	0,5	12.2	То же	0,2	0.02—0.1	0,02—0,1	0.126
Счетчик механический (39)	Десятичный	698	20	(27) Очень мало	5	12.2	»	0,2	0 и 1	0,2	0.126

Note. If memory cells are assembled into memory modules, the playback time is less than 2-3 s.

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*Significantly less than the transmission time to the unit--data user.

**Determined by search time for location of unit on which necessary data are written.

***Overall dimensions of unit with storage device.

****Overall dimensions of storage device.

(Key on following page)

Key:

1. Memory cells
2. Code
3. Overall dimensions, cm^3
4. Overall dimensions per bit of data
5. Power consumption
6. Capacity, J
7. Power, W
8. Time
9. Memory, min
10. Playback, s
11. Write, s
12. Control signal levels, MPa
13. Input
14. Output
15. Minimum power supply pressure, MPa
16. Flip-flop
17. On USEPPA [not further identified]
18. Binary
19. While there is power
20. Unessential
21. On NEMP [not further identified]
22. To SEARCH
23. Memory capacity on USEPPA
24. Decimal
25. Memory capacity on NEMP
26. Pneumatic toggle switch of USEPPA
27. Very little
28. No continuous consumption
29. Unlimited
30. Non-pneumatic
31. Any
32. Digital controllers (switches)
33. Memory on storage units (papertape)
34. Written outside automated control system
35. Dependent on amplifier
36. Memory on storage devices (magnetic tape)
37. USEPPA controller
38. Analog
39. Mechanical counter

The pneumatic toggle switch, memory on the storage units and controllers have unlimited storage time according to the table. Let us consider their application in an automated production process management system. For example, the ten brands of concrete for five of its components (cement, sand, stone, water and chemical additive) in the NORMALIZATION complex are stored by adjustable controllers. The brand of concrete assigned by the operator is called up on the console on the two-input AND module and on the controlled analog contact (AK) module. The outputs of the analog contact modules are connected through the components in the bus. Thus, fifty sensors with analog output signals are installed in the complex. The advantages of the adopted solution include the fact that the analog signal required for operation of the control cell is stored.

The use of memories on storage units (magnetic tape or papertape) is typical for large sequential-reading memory capacities. The disadvantage of these program storage units is the impossibility of online readjustment of them or of changing the stored program and the difficulty of finding the place on the tape where the required data are written. Moreover, the disadvantages of the readers are the complexity of the design and the relatively large air consumption.

But these disadvantages are sometimes not as significant, for example, for storage of th program for punching the layers of the SEARCH integrated circuits. T layers are punched sequentially and up to 50 dies, the program of which is ated on seven lines of an eight-track papertape, operate during each step. . SEARCH circuit layer is processed within 100 steps, while the integrated circuit contains up to 15 layers. Thus, the integrated circuit

processing program is located on 28 m of papertape. However, the strictly controlled sequence of processing the layers and of reading the papertape determine the efficiency of using the punched storage unit.

Unlike sequential readout of programs, the capability of online readjustment of programs must be provided. Thus, for example, when preparing the dyes (dyeing the spools of yarn), the data for the brands of dye must arbitarily be called for production reasons and it must also be corrected periodically. Dispite the large memory capacities, the memory has an original design and small overall dimensions.

It is better to use the main memory, designed on the flip-flop circuits or on the circuits of the capacitive connections with valve in the control cells, since fast write and playback time is typical for these circuits.

Since storage in the capacitive circuit is achieved by cutting off the air in a closed space, the temperature and power supply pressure fluctuations and leakage of air from the chamber limit the storage time.

It is obvious from the given table that the data in the logic units with capacitive memory on the NEMP [not futher identified] can be stored for 15 hours in binary code and 1 hour in decimal code. The power supply can be switched off briefly in this case, which increases the effectiveness of using the memories in automated production process management systems compared to memories on flip-flop circuits.

An example of practical application of capacitive memory is the memory of controlling the proportions of components for the BTUL complex. Up to four BTUL complexes are connected to one NORMALIZATION unit. Five analog values for the time of one measurement, i.e., less than 5 minutes, are stored in the memory capacitors.

According to the requirements on the capacity of the economic indicators, one can conclude that it should be implemented remotely by a controlled non-volatile memory. Counter cells are in best agreement with the given parameters among all the memories.

The counter is a subunit, containing a mechanical-pneumatic pusher and ratchet mechanism with disk punch card attached to an axle. The readout signals are switched upon the call signal. The counter converts from one state to another when a pulse signal is delivered to the mechanical-pneumatic pusher, which rotates the perforated storage device to the next (one of ten) position. Besides the position code, a pulse signal for controlling the mechanical-pneumatic pusher in the counter of the next bit is read during one rotation of the disk.

Counters are used in the UChPLAZIV and UChPROZIV pneumatic equipment complexes, where the concrete production, expenditure of materials and fulfillment of the plan per shift and per month are taken into account. The total number of counters in the UChPROZIV is 48 submodules and that in the UChPLAZIV is 12 submodules.

Operation of the pneumatic memories for two years showed the reliability and simplicity of maintenance by low-skilled personnel.

Analysis of the given materials indicates the possibility of implementing memories for 100 decimial bits within a single section of the NEMP (450 x 660 x 1,000 mm). However, a memory for 10,000 decimal bits, which cannot be achieved in modern memory cells, are required to automate such production as, for example, dyeing the yarn. Therefore, new equipment with smaller dimensions must be developed. The available models of memories that reduce the linear dimensions by a factor of 5-10 show promise of working in this direction to solve the problem of integrated automation of small, but numerous plants with severe operating conditions.

The given analysis shows that known memory cells can execute all the main functions of production data storage within the hardware of the automated production process management system; the cell indicators (by overall dimensions) for one bit of stored data are low and it can be recommended that the range of their application be expanded from the results of development and operation of pneumatic memories.

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IMPROVEMENT OF QUALITY OF SYSTEMS FOR PROCESSING ECONOMIC INFORMATION

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 pp 43-44

[Article under the rubric "Technology Abroad" by Candidate of Economic Sciences S. Stoyanova, People's Republic of Bulgaria]

[Text] At the 12th Congress of the Bulgarian Communist Party, Comrade T. Zhivkov emphasized that in the development of the materials and equipment base for socialism principal attention must be paid not to a quantitative growth in it but primarily to qualitative improvement of production engineering equipment in operation at the present time, by taking into account the ensurance of high labor productivity in the production of high-quality products.

In this connection, the designers of information systems must strive toward the further perfection and improvement of the control system. At today's stage of social development, factors which exert an influence on the quality of control systems and, more precisely, on the quality of systems for processing economic information, are particularly important; these are:

The rapid development of new generations of computers (microprocessors) and, thus, improvement of the quality of information processing systems.

The presence of a skilled work force in sufficient numbers which can work with this equipment. The need for it is due also to widening of the demand for electronic data processing.

One essential element for improving the quality of processing systems is the efficiency of processing. Among methods of reducing the input of programmers' labor, a special place is occupied by the development of programs oriented toward a specific application which can be used, with certain modifications, by various users with provision of the possibility of adapting them to their own needs without the help of the writers of the programs.

One of the most important of today's application program packages (PPP's), developed by the Interprogramma Institute, for data processing, is the SM-SATELLIT ASU [automated control system], or interactive program system for the efficient management of production and storehouses. It includes four sets

of programs: a general-system, production, cost-indicator and storehouse. The functions and tasks of these sets have been described most fully and in very great detail.

The problems discussed in connection with the use of this package can be divided into two types: functional relationship and software-hardware. The functional relationship consists in the division and coordination of functional management tasks between the management levels of an enterprise. The software-hardware relationship consists in the interrelationship of certain kinds of hardware for the purpose of solving the problems posed, by using the appropriate programs (directly distributed processing, which will be discussed below, is in mind).

This package has the advantage that it utilizes dynamic data, i.e., the information is up to date, operating, and discloses the nature of the production process itself (the "Production" set with its specific features), as well as its results, i.e., cost indicators (the "Cost Indicator" set).

The "Storehouse" set is regarded as an auxiliary one which provides the production process with the necessary raw and semifinished materials; however, special attention is paid to it in association with the necessity of economizing on raw and semifinished materials.

Let us dwell in greater detail on the "Cost Indicator" set, by relating its problems directly to the requirements of the economic machinery. How are these problems being solved by computer data processing facilities at several enterprises of the NRB [People's Republic of Bulgaria]?

The Integrated System for Control of Product Quality (KSUKP), introduced at the Combine imeni D. Ganev, makes possible a relationship between the quality of work and wages, the improvement of contracts, and the introduction of the achievements of science, technical progress and advanced know-how, and also makes possible involvement of the public in control of quality and the qualifications of personnel. Improvement of the data processing system, including the calculation of economic indicators in accordance with the "Statute on the Economic Machinery" of the NRB Council of Ministers, is of considerable importance.

The "Cost Indicator" system contains the following: the standardized plan assignment for a brigade of workers; calculation of brigade standard wages; a cost estimate of unfinished production; brigade cost accounting indicators--the standard wages of a brigade; reporting on production and contracts; reporting on actual prices for produced products and materials; defective merchandise by department and brigade; estimate of the defective merchandise of a brigade; and estimate of defective merchandise per operation.

The assignments for a brigade are expressed in the form of a standardized plan assignment, and production schedules and the specific requirements for products to be produced are ratified by its means. The "Statute on the Economic Machinery" calls for the adjustment, in annual plan assignments, of the quality, kinds and range of products when this is occasioned by conditions

of production and sales (the mastery of new products and the introduction of new technologies, changes in consumer demand, etc.).

Operating data processing is performed at two levels--the upper (plant) and lower (department), depending on the tasks and functions which the ASU is to perform. Information associated with the normative reference base of an enterprise is stored at the upper level and serves the purpose of solving problems oriented toward a longer term of execution (e.g., technical-economic planning, etc.). The processing of operations planning information takes place at the lower level (e.g., the preparation of an operation-by-operation schedule). However, there are no precise criteria for dividing information between the two levels; each enterprise does it in its own way.

The software-hardware relationship of the PPP described has several specific problems: they include the data transfer and processing modes; introduction of the interactive mode of inputing, processing and displaying information, as well as the direct pick-up and processing of information at its point of origin; and the development of a data base at two levels: central and local.

Of the information processing modes which are used most often in practice, it is necessary to name the batch mode and the real-time and distributed data processing modes. Let us dwell on the latter mode, since it is conducive to improvement of the quality of the solution of management problems. The formation of a computer network is assumed here, on one hand, and, on the other, the presence of the appropriate software. The necessity of this kind of information processing is due to the specific features of the controlled system.

The software is also implemented at two levels: Minicomputers of the SM-4 type are used at the lower level, and a model of the YeS [Unified Series] series of computers at the higher level. Interaction between them is carried out by means of type SM-1604 or SM-7206 video terminals. The operation-by-operation schedule is prepared on a minicomputer, which brings it to the maximum close to the user of operating information. After the information is processed, it is transferred to the upper level if necessary.

For the purpose of solving the functional problems presented at an industrial enterprise it is important to form a data base which is also oriented toward two levels: central and local. Their presence is responsible for employment of the above-indicated distributed processing mode. The information required for operations management (in association with its tasks) is placed in the local data base.

In distributed data processing, certain difficulties arise relating to the compatibility of various kinds of equipment when it is used, but they are compensated by shortening of the time for data processing.

Here, three kinds of communication are implemented: terminal, interface and program; personal microcomputers can be used for carrying out certain auxiliary jobs.

Interface communication assumes this kind of communication between terminals and computers in the development of a computer network; the program form of communication represents part of the new capacity of data processing systems.

Program communication assumes the existence of the appropriate programs for the two management levels indicated. The ASUP/DOS [Plant Management Automation System/DOS] and ALFA packages, or the PPP's of the IASUP (Interactive ASUP) system, as well as the SETOR-SM, SETOR-SM ZAPROS [QUERY], SETOR-SM RAZVITIYE [DEVELOPMENT], etc., SUBD's [data base management systems], have become widely used in developments by the Interprogramma Institute. Distributed processing has created new relationships between systems programmers and applications programmers.

In conclusion, we would like to stress the following. First, these systems should be helpful at all levels of planning; i.e., they should provide the possibility of accomplishing both the general and specific in the solution of particular operations planning problems. Secondly, the systems are being developed on the basis of two kinds of data bases (central and local), which makes it possible to compare, analyze and the like. Thirdly, the data processing mode is reliable, efficient and user-oriented. The information entry method is the terminal method, which makes it possible easily to make contact with the system, as well as to correct and find information.

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AUTOMATION OF ACCOUNTING FOR, FORECASTING OF RESERVES OF PHYSICAL RESOURCES

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 p 42

[Article by candidates of economic sciences V.V. Stoshkus and V.M. Rutkauskas]

[Text] One important problem presented by the economic experiment is the problem of unutilized and above-norm reserves of physical resources, the level of which to a considerable degree exerts an influence on the final operating figures of enterprises, since increased interest charges are collected from them. Therefore, the problem of the efficient management of production reserves at the regional level, including enterprises and supplying-and-selling organizations, has become particularly topical.

The formation of unutilized and above-norm production reserves of physical resources at an enterprise is caused by imprecise determination of the demand for them. As studies have demonstrated, a number of enterprises overstate the demand for certain kinds of basic types of materials. Above-norm reserves are formed also because of the improper choice of the form of supplying.

On the other hand, unutilized and above-norm production reserves are often formed on account of slip-ups during the stages of planning the supplying of materials and equipment and the order portfolio. For example, the order portfolio is formed at the majority of enterprises only a month before the start of the year being planned, but lists for the delivery of ferrous and non-ferrous metals are presented 125 days before, and for remaining products 45 days before. This situation is conducive to the formation of unutilized and above-norm reserves for some kinds of physical resources and a shortage of others.

An automated accounting, monitoring and forecasting system should straighten out the situation by eliminating above-norm physical reserves. The "Accounting and Monitoring" and "Analysis and Forecasting" subsystems are the most important in it.

The practicability of the development of a subsystem for accounting for and monitoring production and commodity reserves in a region owes itself to the necessity of forming a data base for the subsequent formation of

a reasonable quantity and structure for combined reserves, as well as for making decisions on regulating their level in the process of efficient management. As demonstrated by the experience of creating the accounting system in the Lithuanian SSR Gossnab [State Committee on Supplying of Materials and Equipment], it is appropriate to single out the following tasks in it:

Calculation of norms for commodity reserves at depots.
Accounting for and monitoring of level of reserves at depots.
Accounting for flow of physical resources at a depot.
Operations monitoring of the flow of the most important kinds of physical resources at depots.
Calculation of anticipated reserves at depots.
Accounting for the presence of uninstalled and superfluous equipment and materials at enterprises.
Accounting for and monitoring the state of production reserves at enterprises.
Accounting for and monitoring the state of combined (production and commodity) reserves in a region.

Simultaneously with the solving of these problems, in the process of automated calculation of the demand for physical resources a determination is made of both the basic demand (stated by enterprises during the time of the development of the plan for the supplying of materials and equipment) and the additional demand (stated by enterprises during a plan period).

Thus, the formation of a data base for the demand and reserves makes it possible to implement in the "Analysis and Forecasting" subsystem a model of stochastic forecasting of the level of reserve supplies in a region as a function of the additional demand and above-norm production reserves of physical resources. In this model the total expenditures associated with the formation of a reserve supply are defined as the sum of the cost of storage of the excess reserve stock and possible losses from a shortage of each kind of physical resource.

For the purpose of determining the size of the reserve supply it is necessary to determine, on the basis of actual data for past years, the probability density of the additional demand. As an analysis of actual data on the additional demand has demonstrated, most often it obeys the law of a log-normal distribution, i.e., a need arises for additional small quantities of physical resources, and less frequently for large quantities.

In calculating the size of the reserve supply it is necessary to take into account the fact that part of the enterprises of a region do not fulfill their production plan and they also order unnecessary materials because of slip-ups during the stage of planning the supplying of materials and equipment and the order portfolio. Therefore, plans for deliveries of physical resources to them must be corrected, since otherwise above-norm production reserves can originate. The products freed in the process are earmarked for replenishment of the reserve supply. The situation in this case is similar to that which occurs with the origin of an additional demand; i.e., the distribution curve is a log-normal one.

And so, in automation of the calculation of the level of reserve supplies of physical resources in a region for a plan period it is necessary to carry out the following principal steps (cf. table):

Table

Step	Subject of calculations	Calculation times and frequency
I	Determination of basic demand of region's enterprises for physical resources	Once or twice a year--in preparation of the plan for supplying of materials and equipment
II	Determination of additional demand of region's enterprises for physical resources and formation of data base	Monthly--during the plan period
III	Determination of unutilized and above-norm production reserves at region's enterprises and formation of data base	Quarterly--during plan period
IV	Calculation of parameters of log-normal distribution from data on additional demand and above-norm production reserves	Once a year--prior to start of a new plan period
V	Calculation of level of reserve supplies of physical resources in a region*	Ditto

*For basic calculation equations cf. the following article: Stoshkus, V.V. "Model of Sensible Level of Production Reserves" in "Primeneniye matematicheskikh metodov, vychislitelnoy tekhniki i orgtekhniki v materialno-tekhnicheskom snabzhenii" [Application of Mathematical Methods, Computer Technology and Managerial Aids in Supplying of Materials and Equipment], Moscow, TsNIITEIMS Gossnaba SSSR, No 10, 1982, pp 4-5.

Practical calculations performed for a number of kinds of non-ferrous and ferrous metal rolled products demonstrated that the optimal ratio of the reserve supply and annual demand in the Lithuanian SSR varies from 1.5 to 9.7 percent. These calculations formed the basis of practical measures for the management of reserves of non-ferrous and ferrous metals in the Lithuanian SSR.

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MICROCOMPUTER CONTROL SYSTEM FOR 'UNIVERSAL-15M' ROBOT

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 pp 23-25

[Article by candidates of technical sciences A.A. Alekseyev and F.F. Kotchenko and engineers O.Yu. Belash, M.O. Ilin and Ye.I. Rukosuyev]

[Text] One direction of the Leningrad "Intensification-90" program is the modernization and automation of existing production processes by employing modern computer technology facilities. Because of the universality of microcomputers, they are being extensively introduced into production systems, in particular, in control systems for industrial robots (PR's). The use of microcomputers makes it possible to construct universal control systems with the possibility of readjusting for a specific type of PR, and to improve the reliability of control systems, as well as to increase productivity on account of shortening of the time for training a PR and editing control programs, to expand the production-process capabilities of existing PR's, to form complicated mechanical trajectories for the PR's working member, to receive, process and output signals to external production-process equipment, and to maintain communication with a higher-level control system.

At enterprises there are a great number of PR's of various types with obsolete individual control systems and having poor reliability, a limited number of positioning points, the impossibility of the formation of complex mechanical trajectories for the robot's working member, and poor error-probability performance and, as a consequence, the possibility of the occurrence of accident situations. For example, the experience of using the "Universal-15M" PR under in-plant conditions has demonstrated a number of shortcomings.

Therefore, the "Universal-15M" industrial robot control system was developed, based on an SM 1800 microcomputer (fig 1). The use of a microcomputer made it possible to eliminate from operation 80 percent of the equipment of the APS-1 [automatic signal transmitter] rack, which improved the operating reliability of the entire control system as a whole. The microcomputer is connected to the industrial robot through its own standard controlled-system interfaces (USO's) and an interfacing unit (BS) which was developed. Six voltages, U_z, which determine the amount of displacement of the PR's working member for six degress of mobility, enter the R-C network of the BS unit from the analog signal output module (MVAS). Voltages U_z are amplified in level

by scalers U1 to U6 and are established in the inputs of the APS-1 rack. The differences of voltages U_z and the voltages, U_p, of position pickups DP1 to DP6 are amplified as error signals, U_r, by amplifiers UN1 to UN6 and enter the EPT-6 thyristor drive rack. Signals U_s from tachometer generators TG1 to TG6 are subtracted from signals U_r and the difference voltages, power-amplified and transformed with respect to shape by power amplifiers UM1 to UM6, are supplied to actuating motors ID1 to ID6 of the drives for the robot's degrees of mobility. At the moment when the robot's working member arrives at the predetermined point in space, amplifiers UN1 to UN6 generate service signals for all six degrees of mobility. These signals are united by means of an AND gate into signal U_1, which enters the microcomputer via the discrete signal input module (MVVDS). With this signal the microcomputer proceeds to the subsequent operations for controlling the industrial robot. The robot's working member is controlled through the discrete signal output module (MVDS). The modernized control system, by means of six discriminators, D1 to D6, and the OR gate of the BS unit, also makes possible automatic self-switching-off of the robot with impermissible deviations of the working member from the specified mechanical trajectory. By uncomplicated switching, the "Universal-15M" PR can be controlled completely from its own control system.

The basis of the system's software is a program for processing any set of points in space for any number of degrees of mobility provided in the industrial robot. The positioning points in space are determined by the industrial robot's mechanical trajectory. A flowchart of the trajectory processing algorithm is given in fig 2.

The voltage matrix is in the form of voltage codes for the individual degrees of mobility for all programmable points of the trajectory in space. Initial data are input from a console.

The algorithm makes it possible to specify serial, I, or parallel, II, trajectory completion modes. In the serial mode control with reference to a point in space is performed serially for each controlled degree of mobility. Thus, the robot's mechanical trajectory toward the point in space is of a stepwise type. In the parallel mode control with reference to a point in space is performed simultaneously for all controlled degrees of mobility. The parallel mode has higher speed than the serial. But the serial mode is preferable, for example, in adjusting the trajectory and with the complexity of access to a specific point in space. The trajectory completion mode is assigned from the console. The MVVDS is polled first in the serial mode. With the arrival of a completion signal, voltage, U_z, is output to the next controlled degree of mobility, and the process is repeated until all degrees of mobility have been run through. In the parallel mode voltages U_z are first output for all degrees of mobility and then the completion of displacements for all degrees of mobility is awaited by polling the MVVDS. When all degrees of mobility have been run through, the state of the working member is checked.

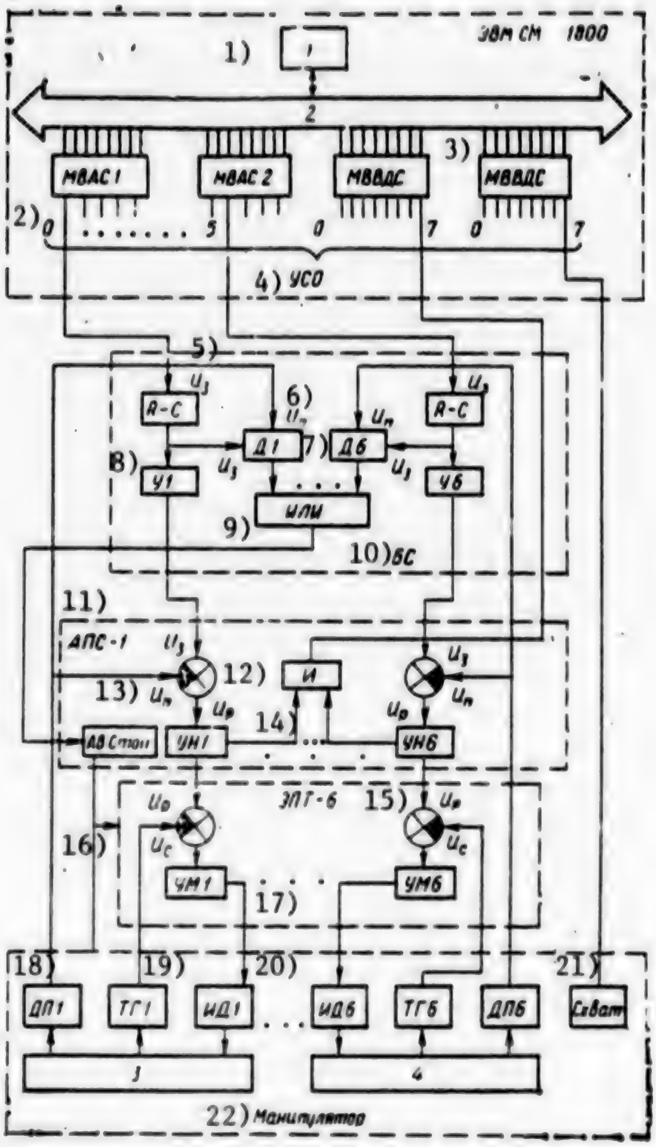

Figure 1. Functional Diagram of Control System: 1--processor; 2--interface; 3--degree of mobility No 1; 4--degree of mobility No 6

Key:

1. SM 1800 computer
2. MVAS1 [analog signal output module]
3. MVVDS [discrete signal input module]
4. USO [controlled-system interface]

[Continued on following page]

5. U_z
6. U_p
7. D1 [discriminator No 1]
8. U1 [scaler No 1]
9. OR gate
10. BS [interfacing unit]
11. APS-1 [automatic signal transmitter]

12. AND gate
13. Automatic stop
14. U_F
15. EPT-6 [thyristor drive]
16. U_s
17. UM1 [power amplifier No 1]
18. DP1 [position pickup No 1]
19. TG1 [tachometer generator No 1]
20. ID1 [actuating motor No 1]
21. Gripping device
22. Manipulator

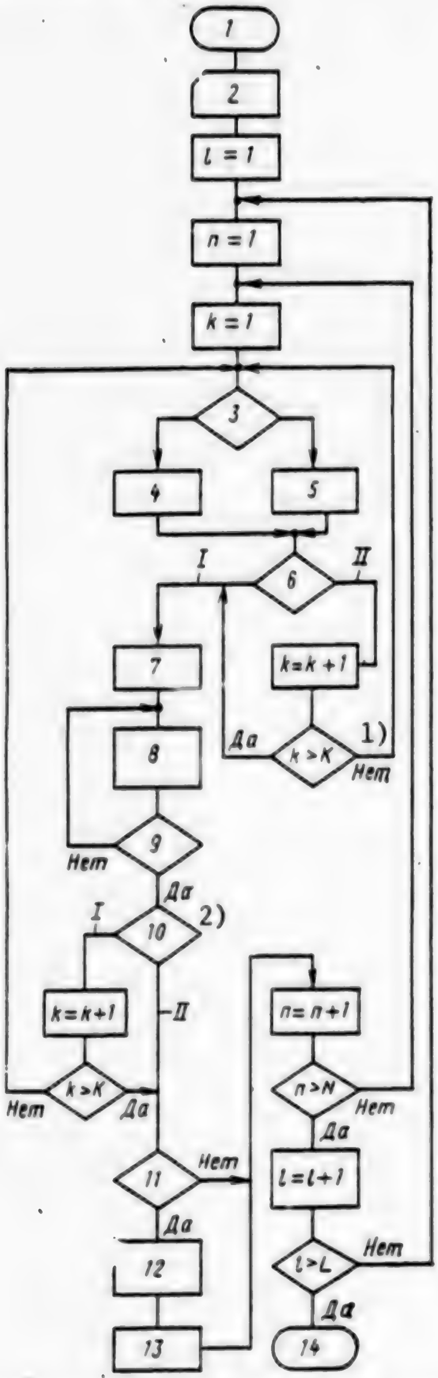

Figure 2. Trajectory Processing Algorithm Flowchart:
[Continued on following page]

1--Start; 2--L , N , K , mode, voltage matrix; 3--number of MVAS; 4--output of U_z to MVAS1; 5--output to MVAS2; 6, 10--mode; 7, 13--delay; 8--poll MVVDS; 9--Movement Completed?; 11--change of state of robot's working member; 12--output of state of robot's working member to MVDS; 14--End; K--number of controlled degrees of mobility; k--degree of mobility order number; N--number of points of trajectory in space; n--order number of point of trajectory in space; L--number of trajectory completion cycles; ℓ--order number of trajectory completion cycle

Key:
1. No
2. Yes

If it is necessary to change this state, the corresponding value of the state of the working member is output to the MVDS. After the point in space has been completed, a check is made of the number of completed points. The numbers of completed cycles are checked at the end of completion of the trajectory. The "Delay" units are used because of the system's sluggishness (as compared with the speed of computer machine instructions). One "Delay" unit makes it possible to poll the MVVDS not immediately after the output of voltage. Otherwise the correctness of the signal is not guaranteed. The delay equals 10^{-3} s. The other "Delay" unit makes it possible to fix the position of the working member when its state is changed. The delay equals ~0.7 to 0.8 s.

The ASSEMBLER language was used in programming. The system's software occupies less than 1K bits of the computer's memory. In the process of operation the microcomputer can be used in parallel for serving another kind of equipment or for performing various control and computing functions.

Thus, the modernized control system for the "Universal-15M" industrial robot makes the following possible: to connect any computer with a standard controlled-system interface (microcomputer, minicomputer, etc.); to specify complex trajectories in space; high reliability of the entire control system; the elimination of accident situations on account of the addition of a self-switching-off unit in the BS [interfacing unit]; the ability to communicate with a higher-level control system; and the possibility of flexible reaction to a change in situations in the framework of a flexible production system under conditions of small-scale production.

8831
CSO: 1863/36

AUTOMATED MILKING MACHINE

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Unattributed article: "Computer-Milker"]

[Text] The computer-milker is endowed with the experience of its "human prototype" and the knowledge of a veterinarian and a zoological engineer.

The specialized electronic system, created by scientists at the Leningrad Veterinary Institute in cooperation with instrument makers, is successfully passing tests at a dairy of the "Gatchinskiy" sovkhoz (Leningrad Oblast).

A computer on the farm proved to be a competent aid in all aspects of milk production technology. Operating subtleties which, in some instances, do not always turn out well even for an experienced operator, are within the power of the electronic milkmaid. Milking according to the given program is conducted without detriment to the health of the livestock. As soon as milk extraction is completed, the milk containers are switched off. The system indicates this with light and audio signals.

In the photo: (left to right) S. Krasnov, senior scientific associate of the dairy cattle breeding automation laboratory of the Leningrad Veterinary Institute, A. Suprunovich, sovkhoz automated complex engineer and S. Grigoriev, engineer of the milking management automated center of the complex. Photo I. Kurtova (TASS) [Photograph not reproduced.]

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UDC 006.354.065:001.8:006.032/.039

IMPROVEMENT OF SET OF STATE STANDARDS, GUIDELINE DOCUMENTS FOR COMPUTER-AIDED DESIGN SYSTEMS

Moscow STANDARTY I KACHESTVO in Russian No 9, Sep 86 pp 13-15

[Article under the rubric "Standards: Technical Progress, Economy, Efficiency; Automation of Documentation Development" by Ye.S. Krankov and S.A. Terpeneva, VNIINMASH [All-Union Scientific Research Institute of Standardization in Machine Building]]

[Text] The requirements of scientific and technical progress dictate the necessity of developing in a short space of time highly efficient equipment with quality indicators not inferior to those of the best models in the world. In this regard, the most important stage of the life cycle of products is the design stage, on which principal quality indicators rest and on the efficiency of the work of which the time it takes to develop products depends to a great degree.

The traditional methods of manual designing do not make it possible to solve the problem of speeding the development of and putting into production new generations of high-efficiency equipment, and only the use of computer hardware and mathematical methods in the designing of products under conditions of a computer-aided design system (SAPR) will make it possible to solve the problems presented by the requirements of scientific and technical progress.

The decree of the CPSU Central Committee and USSR Council of Ministers titled "On Measures for Speeding Scientific and Technical Progress in the National Economy" calls for the extensive development of automation, including in the field of design-engineering work. The USSR Gosplan, GKNT [State Committee on Science and Technology] and the USSR Academy of Sciences, with the participation of interested ministries, have developed an all-Union program in the area of computer-aided design systems.

The technical standards provisions for this program were entrusted to Gosstandart [State Committee on Standards]. Gosstandart developed a set of measures for the purpose of implementing this assignment. The principal ones of these are the following:

1. The development of a set of State standards and guideline and procedural documents for standard methods of performing and documenting work. This measure included a review of existing standards and the development of procedural instructions and recommendations on the performance of predesign research and on the documenting of SAPR components and method software systems (PMK's).

2. The development of SAPR invariant components and method software systems. This most important measure was aimed at development of the general-system core of an SAPR. Its makeup should include the following: an SAPR interactive monitor implementing automated planning and control of the design process, including providing the designer access to these processes; a data base management system (SUBD) providing for the information requirements of design procedures and the information compatibility of various PMK's; and a geometrical processor implementing the geometrical modeling of items being designed, etc.

3. The development of State standards and technical requirements for method software systems for SAPR's.

4. The development of guideline and procedural documents on the interaction of SAPR's with flexible production systems and ASU's [automated control systems] in machine building.

With the development of these documents a unified automated chain will be regulated, including both the designing and engineering of a product, its production-process design, and the production of programs for equipment with numerical control, making it possible to make the designed product under conditions of flexible production systems.

5. The development of standard methods, solutions and method software systems for the computer-aided design of products. This includes the development of the following: standard functional diagrams for the designing of products; methods for the geometrical modeling of two- and three-dimensional entities; communicative formats for describing printed circuit boards; basic PMK's for the computer-aided design of parts and assembly units, for forming the structure and products at the level of physical effects and structural components, etc.

6. The development of standard methods, solutions and method software systems for computer-aided production-process design. This set of NTD [technical standards documentation] can be characterized as documentation regulating computer-aided design under conditions of the functioning of flexible production systems, since it includes documents for the development of production-process design methods and PMK's for the following functions: assurance of streamlinability, the designing of production processes, the preparation of programs for equipment with numerical control, and the designing of production-process equipment.

7. The development of a set of guideline and procedural documents relating to the procedure for an examination by experts and the standardization of SAPR

method software systems. The classification of PMK's as products for production engineering purposes necessitates the establishment of a unified procedure for developing them, testing, examination by experts, standardization, funding and application.

The above-listed measures supplement the existing set of State standards and guideline documents on SAPR's, defining terms, stages of development, the structure and content of work by stages, the structure, content and symbolism of documents on SAPR, and organization of the creation and development and evaluation of the quality indicators for the creation of SAPR's. The structure of SAPR's is regulated by eight State standards, four guideline documents and some procedural recommendations which establish a unified concept for the structure of an SAPR: makeup, classification, specifications for kinds of facilities, and standard components.

The existing set of State standards for SAPR's has been analyzed at the present time for the purpose of developing suggestions for improving it, in fulfillment of Decree No 65, of 14 January 1986, of the USSR Council of Ministers, titled "On Improvement of the Procedure for Developing and Coordinating Technical Documentation in the Development and Putting Into Production of New (Modernized) Machine Building Products."

The number of existing standards has been reduced in accordance with the suggestions made.

Nine State standards (GOST [All-Union State Standard] 23501.2-79, GOST 23501.3-79, GOST 23501.5-80, GOST 23501.7-80, GOST 23501.11-81, GOST 23501.12-81, GOST 23501.14-81, GOST 23501.15-81 and GOST 23501.118-83) have been abolished from 7 May 86 to 1 Jun 86 by the decree of Gosstandart. For the purpose of eliminating from documents requirements of a procedureal nature and organization questions relating to the development of SAPR's, including the procedure for coordinating and approving documents, it has been planned to develop--in place of the above-indicated State standards (excluding GOST 23501.12-81) and GOST 23501.106-85 and RD [guideline document] 50-245-81--two guideline documents: "SAPR's. Structure, Content and Documentation of Work in Process of Development of Systems" and "SAPR's. Documentation of Components by Kinds of Facility."

Before these documents are published, the abolished standards can be used as the recommended.

The plan is to develop also in 1987 the State Standard titled "SAPR's. Principal Regulations" to replace the State standards setting the requirements for individual kinds of facilities and for organizing the development of SAPR's (GOST 23501.0-79, GOST 23501.4-80, GOST 23501.9-81, GOST 23501.12-82. GOST 23501.13-81, GOST 23501.16-81 and GOST 23501.17-82).

The state of the implementation of these measures is illustrated in the diagram.

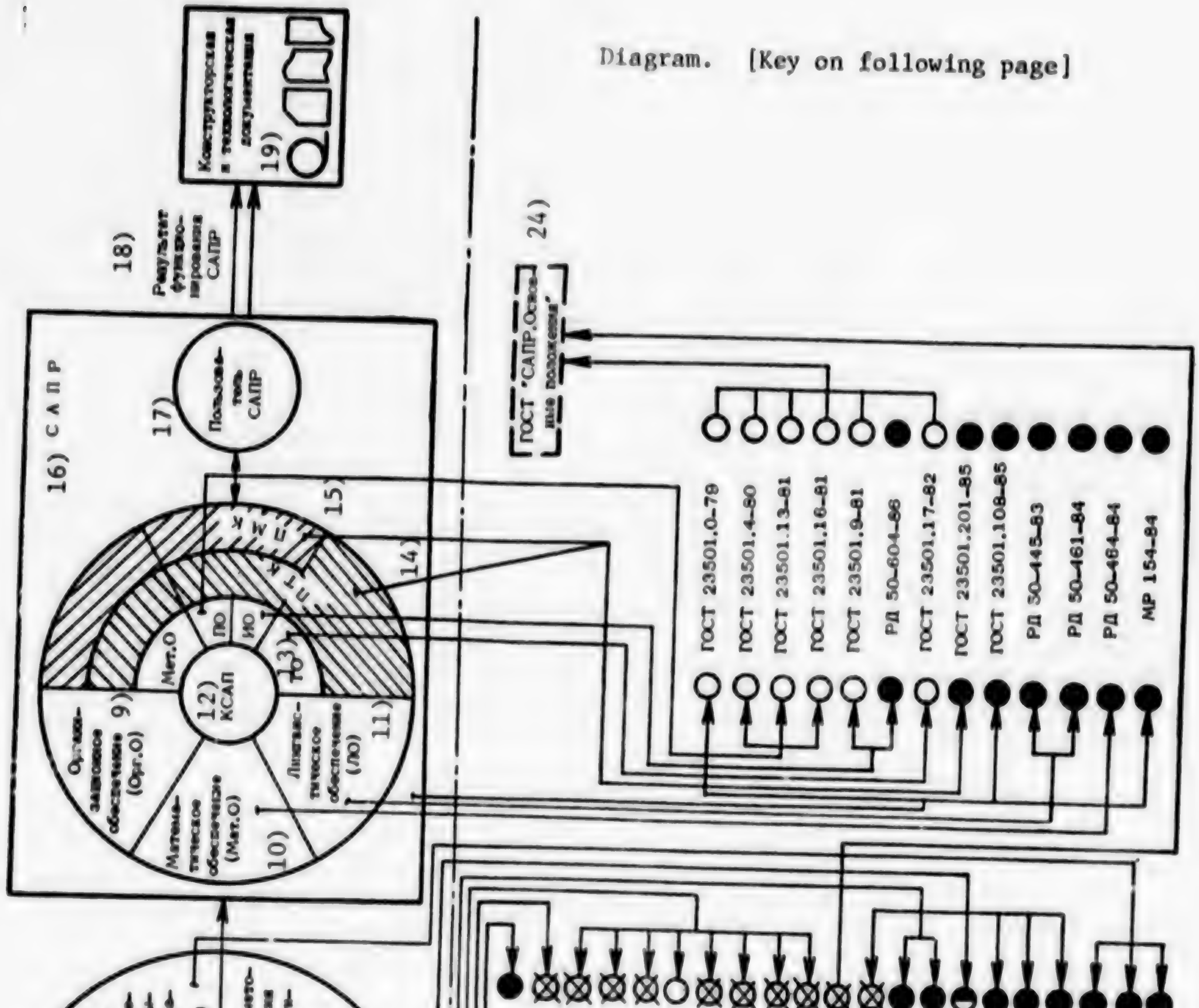

Diagram. [Key on following page]

Key:

1. Items to be standardized
2. Stages of development
3. Terms
4. Standard methods and solutions for performance of work
5. Standard methods and solutions for documentation
6. Types and sets of documents
7. Makeup and content of work
8. Process of development of SAPR
9. Organization facilities
10. Software
11. Linguistic facilities
12. KSAP [set of computer-aided design facilities]
13. TO [hardware], IO [data base organization and management], PO [software], Met. O [procedural facilities]
14. PTK [software-hardware system]
15. PMK [method software system]
16. SAPR
17. SAPR user
18. Result of functioning of SAPR
19. Design and production-process documentation
20. GOST's, RD's and MR's [procedural recommendations]
21. GOST 24.601-86, "Automated Systems. Development Stages"
22. RD "SAPR's. Structure, Content and Documentation of Work in Process of Development of System"
23. RD "SAPR's. Documentation of Components by Kinds of Facility"
24. GOST "SAPR's. Principal Regulations"

Symbols:

● ● Norm-setting document on SAPR's in effect at present.

⊠ ⊠ Abolished document.

◑ ◑ Document suggested for development in place of abolished one.

○ ○ Existing document proposed to be abolished.

▭ Document developed in place of abolished one.

⬚ Document being developed at present time to replace abolished one or to replace suggested one.

The arrows leading from the circles point to the documents developed or to be developed to replace the State standards or RD's indicated.

After the completion of work on the improvement of the set of standards, the set of NTD's regulating the structure of SAPR's in the process of developing them will include seven State standards and eight guideline documents, namely: GOST 22487-77, GOST 24.601-86, GOST 23501.10-81, GOST 23501.108-85, GOST 23501.119-85 and GOST 23501.201-85, the State standard titled "SAPR's. Principal Regulations", the RD titled "SAPR's. Structure, Content and Documentation of Work in Process of Development of Systems", the RD titled "SAPR's. Documentation of Components by Kinds of Facility", and RD 50-250-81, RD 50-459-84, RD 50-445-83, RD 50-461-84, RD 50-464-84 and RD 50-604-86.

Five documents have also been developed at the level of procedural recommendations: MR 116-84, MR 194-85, MR 187-85, MR 123-84 and MR 154-84.

The performance of all the work planned will make it possible to improve the quality of NTD's by taking into account the experience of many years of the use of standards in organizations of branches of industry in the development of SAPR's, and to eliminate unnecessary regulation of the creative activity of SAPR developers by lowering the category of norm-setting documents (changing individual State standards into RD's) and eliminating requirements of an organization and procedural nature from them.

The further development of standardization in the field of SAPR's in the 12th Five-Year Plan period, as was said above, will be directed toward the development and standardization of standard method software systems (PMK's), representing a product for production engineering purposes. These PMK's can be used as components of SAPR's in the development of them, which will make it possible to improve considerably the efficiency of work on standardization and to solve the problem of the development of SAPR's in small and medium-size planning and design organizations.

All this will be conducive to reducing by approximately 25 to 30 percent the labor intensiveness of the development of SAPR's in organizations of branches of industry and to improvement of the quality of systems created.

8831
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UDC 621: 65.011.56:Δ65.015.11

INTERACTIVE COMPUTER-AIDED DESIGN SYSTEM

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 36-39

[Article by Candidate of Technical Sciences I. F. Ushakov]

[Text] The need to increase significantly labor productivity in engineering preparation for production predetermined the timeliness of the problem that concerns the development and introduction of computer-aided design and manufacturing systems (SAPR TP) in industry. This work has been conducted most intensively by a number of organizations and enterprises of Minstankoprom [USSR Ministry of Machine Tool- and Tool-Building Industry] during the past decade. It is during this period that CAD/CAM, developed by State Design-Manufacturing Institute of Woodworking Machine-Tool Building (Pskov) and Orglitmash [not further identified] (Rostov-na-donu) and the Ryazan and Minsk Branches of the NPO [Scientific Production Association] Orgstankinprom, began to function in the plants of the sector. Relatively weak functional capabilities (the design of production processes of machining some classification varities of parts using universal equipment is usually possible) and understatement of the role of the operator-technician, who performs only functions of preliminary manual coding of input data for subsequent machine design of technology, are typical for these systems.

Sequential fulfillment of functions by the technician and computer in combination with nonautomated routine labor of the technician makes it possible to relate the corresponding CAD/CAM systems to first- and second-generation systems. (Footnote 1) (I. F. Ushakov, "Sistemy avtomatizirovannogo tekhnologicheskogo proyektirovaniya v melkoseriynom i seriynom mashinostroyenii" [Computer-Aided Design/Manufacturing Systems in Small-Serial and Serial Machine Building], Moscow, VNIITEMR, 1985, 36 pages)

The general view toward the problem of computer-aided design/manufacturing is now changing. The national economy needs products as a whole rather than individual classification varieties of parts, toward which the first- and second-generation systems are oriented.

The experience of the State Design-Manufacturing Institute of Woodworking Machine-Tool Building (GPTIdrevstankoprom) in development of third-generation CAD/CAM systems at the subsector level is illuminated in the article.

The distinguishing feature of the developed CAD/CAM system is its orientation toward working up the required set of production documentation for each newly assimilated product. The basic requirements on the system with this postulation of the problem is complex nature, universality, integratability relative simpliticy, possibility of development and improvement and maximum economy.

The complex nature of this system is provided by the fact that technician-computer interaction according to previously developed scenario is adopted as its determining functional mode. Each such scenario regulates the logical sequence of heuristic decision-making in production design in the interactive mode, i.e., it is its own type of interactive design algorithm. The scenario for any interactive problem is formulated according to a single method, which creates prerequisites for connecting the required set of tasks to the system.

The universality of the system is the consequence of the interactive nature of immplementing the most important tasks. The possibility of going beyond the bounds of the software or basic database management and organization of the specific features of a specific enterprise (unlike the second-generation system) is achieved in this very case.

These features are regarded as online information, entered into the computer during direct interaction between the technician and computer. Accordingly, the system is invariant with respect to the specifics of the enterprises operating it and does not require any principle adjustment of any kind for conditions of a specific user.

The integratability of the third-generation system is considered by function (horizontal) and by levels (vertical) of production design. The scenarios of all interactive tasks are constituent parts of a single systems scenario with free access to each of them during operation of the CAD/CAM system. It is sufficient upon request of the computer to communicate the feature of the corresponding scenario (horizontal integration) to the display operator for conversion to any interactive task; one reaches the required level of production design (for example, according to the itinerary-operation-control program of a machine tool with ChPU [numerical program control]) automatically according to the feature formulated in the dialogue (vertical integration).

The relative simplicity of the system is confirmed primarily by the fact that technician-computer interaction is maintained in natural user language, i.e., the operator is not required to know any artificial formal languages. Moreover, the initial startup of the system also does not require a specific database, oriented toward a specific user. The period of assimilating the system depends only on the time that the operator-technicians study the scenario of interactive tasks and on their acquiring the corresponding skills of working at the display unit to be used.

The capability of developing and improving the system is supported by the following: the information and program complexes of the CAD/CAM system have block-modular organization that permits constant connection of new scenarios and tasks (functional development of the system). The content of the dialogues to be used has a tendency toward constant simplification as experience is

accumulated in operating the CAD/CAM system and of developing on this basis interactive macrodefinitions (qualitative improvement of the system).

Maximum economy of the system is achieved due to the insignificant required resource of the computer (100 kilobytes of main memory and 1 problem-oriented disk drive) and also by the capability of multiterminal functioning of the interactive part of the CAD/CAM system.

The set of functional subsystems and tasks of a the CAD/CAM system reflects the adopted orientation of the system toward working out the set of production documentation for each newly assimilated product.

A brief description of the subsystems and tasks that comprise the first stage of the CAD/CAM system and that are in different stages of development is given below.

The product information preparation subsystem encompasses the functions related to classification of data on magnetic carriers about manufacturing preparation of objects (parts and assemblies included in the product).

Task 1.01 "Service processing of systems data sets" has specific designation and for this reason is not considered in more detail.

Task 1.02 "Formulation of general data about production preparation objects" is intended for initial (and one-time organization and formatting on magnetic disk of those data about the production preparation objects, which are essentially used in each subsequent task of the system (name and designation of the part, its overall dimensions and weight, name and brand of material and so on). Moreover, the design-production code and the summary cipher of the macro-profile of the material are formulated for each part. The task is implemented in an interactive mode.

Task 1.03 "Check and correction of common data about production preparation objects" logically supplements and completes tasks 1.02. It permits one to call to the display screen general data about any production preparation object (according to the direct-access principle), which permits one to check visually the data formulated earlier and if need be to correct them and again write to the magnetic disk in the new edition.

The classification analysis subsystem encompasses the preparatory functions, related to classification and analysis of the most important classification structures of the product to be newly developed, which is the main prerequisite for qualitative implementation of the production design tasks.

Task 2.01 "Classification anaylsis of parts of the product" classifies the production preparation objects contained in the product (parts and assemblies) according to the design-production codes, and the following are determined by using it: a general list of those codes in the product, the number of names, units and lists of parts having the same code and the weight characteristic of a group of parts, combined by a single design-production code.

Task 2.02 "Classification analysis of macroprofiles of materials" is a complete analogue of task 2.01, but its algorithms use summary figures of the macroprofiles of materials. Tasks 2.01 and 2.02 do not require interaction, i.e., they are implemented in the automatic mode.

The production process design subsystem, being the central system, supports automated development of all the necessary set of production documentation and normalization of production processes as a whole for the product with regard to all the types of production existing at the corresponding enterprise.

Task 3.01 "Design of manufacturing processes according to blank-stamping production" has the obvious designation.

Task 3.02 "Design of manufacturing processes for machining parts" is characterized by some features from the viewpoint of traditional views toward the corresponding function of production preparation: there is not artificial autonomy of the individual components of this function, related to determination of the classification varieties of parts (bodies of rotation, flat parts, housings and so on) or to machining parts on different types of equipment (universal machine tools, automatic machines, machine tools with numerical programming control and so on). In other words, the task integrates working out documentation for production processes, performed on metalworking equipment.

Task 3.03 "Design of production processes for assembly of units and parts" has the obvious purpose.

Task 3.04 "Design of production processes for acceptance check of parts" has the goal of strict regulation of both the metrological equipping of production and of the process itself of measuring the specifications of production preparation objects and of determining their conformity to the drawings and specifications.

Task 3.05 "Design of production processes of welding assemblies" has the obvious purpose.

All tasks of the subsystem under consideration are implemented in the interactive mode.

The normative calculations subsystem encompasses the functions that directly follow from the production design tasks and are related to calculation and classification of labor, material and other norms for the product to be newly developed.

Task 4.01 "Calculation of detail-specified norms of consumption of rolled pipe" realizes the obvious and obligatory function of production preparation of the new product.

Task 4.02 "Calculation of normal laboriousness for a product" is based on the resulting information of the tasks of the production process design subsystem and provides classification of the calculated laboriousness for types of work, groups of equipment, occupations, ranks of jobs and so on.

Task 1.03 "Calcultion of normal consumption of cutting tools" is a logical continuation of task 3.02 and has the obvious designation.

Among the ennumerated thirty functional tasks, eight (1.02, 1.03, 3.01, ..., 3.05, 4.01) are implemented by interaction, whereas the remaining five (1.01, 2.01, 2.02, 4.02 and 4.03) are executed in the automatic mode.

Each individual scenario of interactive tasks is expressed from the formal-information viewpoint by the combination of two, logically related modules, the first of which reflects the problem-content aspect of the interaction and the second reflects the management of interaction.

The problem-supporting module (conditional identifier T) includes interactive directives and requests, information messages to be used in interaction, references of possible production decisions, alternative situations of management of the interaction and working fields of arrangement of online interactive information. In other words, all the information which is output or can be output to the alphanumeric display screen during implementation of the interactive task of the CAD/CAM system is classified in module T.

The interaction maintenance module (conditional identifier V) classifies the elementary procedures of maintaining a dialogue in a specific task of the CAD/CAM system. Each such procedure is an independent interactive information processing function. The list of these functions is comparitatively short (approximately twenty names). The description of their content and formal representation in module V is a subject of special consideration and goes beyond the framework of this article.

The combination of scenarios of interactive tasks is the so-called knowledge base of the system (unlike the traditional database), which is the most essential and most valuable part of the third-generation CAD/CAM system.

The computer hardware to be used for the third-generation CAD/CAM system includes the YeS-1022 computer and the YeS-7906 or YeS-7920 video terminal station. The programs of the system have four main sections: the service programs of the database, the interction support programs, the math programs and the production documentation formulation programs. The service programs (section 1) are related to task 1.01, have special designation and are not considered here.

The interaction support programs (section 2) are invariant with respect to specific scenarios of the functional tasks of the CAD/CAM system. They include the pilot program (manager) and set of subroutines; each of them corresponds to a specific interaction procedure. The load program module of the interactive part of the system is thus a single module and is used to implement any scenario.

The math programs (section 3) encompass the original functions of the tasks, related to arithmetic conversion of the information formated in interaction and implemented in automatic mode. Examples of these functions are computation of the detailed norm of materials consumption, computation of the time norm for conversion or operation and so on.

The print programs (section 4) support output forms of production documentation of the established model on the computer.

The program texts are written in PL/1 algorithmic language and the individual systems programs are written in Assembler language. The operating system is OS, version 4.1 and higher.

Any production preparation object in the system is identified by two features, including the letter of the inclusion product and the conditional number of the part (assembly). Both the letter (any character of the Latin alphabet) and the number (the number that reflects the physical ordinal arrangement of the drawing, part or assembly in the set of design documentation) are online information, written on disk together with general data about the production preparation object (task 1.02) and further serve as the direct-access key to the corresponding information in any task of the system.

Thus, the CAD/CAM system can be adjusted to a specific production preparation object in direct interaction, which permits online conversion to computer-aided design of any part or assembly of any product.

The interactive software is designed for multiterminal functioning of the system, i.e., toward simultaneous and parallel use of all the displays of the operating video terminals. Each display is organizationally independent of the other displays when solving interactive tasks of the systems.

Production design tasks are solved according to a unified scheme: an interactive set of input data, the computation part and formulation of the resulting documentation.

The result of interaction is formulation on magnetic disk of the formalized production process of machining the part (assembly). Automatic processing of the formalized production process for technical normalization of operations and transitions is achieved in the computation part. The concluding part is related to printing out the production process according to established format.

Each of these parts is implemented offline, which permits one to review the intermediate production design data through the display screen and permits possible correction of it.

There is no coding tablet-type document in the system, which is traditional in first- and second-generation CAD/CAM systems. General data about the production preparation objects, as already noted, are formulated in task 1.02. With regard to more detailed characteristics of production preparation objects (for example, data about surfaces), they are entered in the computer in the interactive part of the corresponding task of the system.

Thus, one can make the following conclusions. Development and introduction of the third-generation CAD/CAM system arms machine builder-technicians with qualitatively new, modern methods of production design when setting up new machine tools, machines and equipment for production.

Extensive use of man-computer interaction opens up the capability of direct connection of the technician's intelligence and the enormous speed of the computer, sharply reduces the amount of routine and low-productive labor and predetermines to the same extent the development of the specialist's creative capabilities.

In the final analysis, all this is the basis for a significant increase of the effectiveness of engineering preparation of production in machine building.

The described system is in experimental operation at GPTIdrevstankoprom and is being assimilated by a number of enterprises and organizations of different sectors of the national economy. The elements of the system are used actively in the training process of the Pskov Branch, Leningrad Polytechnical Institute, in training mechanical engineers.

6521
CSO: 1863/34

COMPUTER-AIDED DESIGN IN PIPE INDUSTRY

Kiev PRAVDA UKRAINY in Russian 26 Oct 86 p 3

[Article by V. Druyan, doctor of technical sciences, professor, head of the Dnepropetrovsk Metallurgical Institute Design Department and USSR Council of Ministers prize laureate: "The Computer Advises"; under the rubric: "In Competition for the Ukranian SSR State Prize"]

[Text] The problem of the wide introduction of computers and economic-mathematic methods into the sphere of economic activity is of ever greater importance, especially in the capital intensive branches, where the large product lists of production are. The pipe industry is one such branch.

The demand for high quality steel pipes constantly grows and exceeds the current capacities of pipe factories and shops. The branch has its special features: an unlimited diversity of pipe types and dimensions, and it is possible to fabricate them according to many different production flowcharts and on different equipment. Therefore, in order to choose the optimum production strategy, it is usually necessary to work out a great number of design solution alternatives.

It is then that computers come to the rescue. They allocate orders among factories and shops quickly, using the best method. With their help a project designer can determine the optimum alternative from the choices of reorganizing, technical retooling, constructing new shops or using existing shops. But it is difficult to "teach" a computer to do this.

Solving the problem of "Development and Implementation of an Optimum System for Designing and Utilizing Pipe Industry Capacities" is of urgent interest. Completion of the complex multi-plan task would be impossible without thorough analysis and broad generalizations of pipe production theory and practice, or a critical comprehension and full development of design technology with the aim of creating shops which correspond to the leading level of world technology.

The most complex economic tasks require the basic software. Original methods suggested by the authors have received recognition not only in our country, but also abroad. Research conducted in the International Institute of System Analysis has convincingly demonstrated that the methods of Soviet scientists are much more effective than those used by specialists abroad.

Perhaps on of the major merits of the work being examined is the organic unity of its mathematical algorithms with the economic and organizational pipe production scheme. Only after interaction with a computer can the need for creating new capacities in pipe production be determined. Designing a new project is also done by using a computer. With real-time modification, the capabilities of real production create the conditions for filling all customer orders.

Specialists who represent the links of the chain "science - design - production" are united in a close creative union. The enthusiasts among the larger institutes and enterprises of the country are VNITI [All-Union Scientific Research Pipe Institute], Ukrgipromez [Ukrainian State Institute of Metallurgical Plant Design], the UkSSR Academy of Sciences Institute of Cybernetics and others. Pipe factories, the first of which is the Nikopol Southpipe plant, have become a gigantic practice area ["polygon"] for the introduction of the system.

Using a developed system in the design process has perplexed even experienced specialists more than once. It is enough to remember how a new shop, using a basically new technology for thick-walled large-diameter pipe fabrication, was designed. The industrial engineers foresaw the need to install more than 70 units of equipment in the production line. They decided to determine the optimum number with the aid of a computer. Imagine the surprise when it was made clear that the assigned production plan could be fulfilled with 23 equipment positions, if correctly installed in the production line. The result was an economic impact of nearly 500,000 rubles.

Using the developed design methods in a number of shops in the Nikopol Southpipe Plant, the largest in the country, Volga Pipe and other factories, has resulted in an economic impact of more than 11 million rubles. The country has saved more than half a million tons of metal by applying production planning optimization and large-scale pipe allocation methods.

This information allows the conclusion that the work which has been performed at a high scientific level is a serious contribution to the solution of practical problems concerning intensifying and raising the efficiency of the economy.

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INTRODUCTION OF AUTOMATED DESIGN SYSTEM FOR MECHANICAL WORKING PROCESSES IN OIL FIELD EQUIPMENT PRODUCTION

Baku NARODNOYE KHOZYAYSTVO AZERBAYDZHANA in Russian No 8, Aug 86 pp 44-49

[Article by R.G. Libenson, All-Union Scientific Research and Design Engineering Institute of Petroleum Machine Building]

[Abstract] When the system for automated design of technological processes for petroleum industry machine building plants was set up, it was decided to create a collective-use system rather than creating small, scattered subdivisions at individual plants. It was further decided to base the design of the system on an existing system, rather than design it from scratch. Due to the short-run, specialized nature of petroleum equipment manufacture, it was decided to use the technological process design system for mechanical working developed by the Scientific Research Institute of Cryogenic Machinery Manufacture as a model. A data base of capabilities of manufacturing equipment at each member plant was created. Major trends in the improvement of the manufacturing system included improvement in the structure of part descriptions, introduction of logical and geometric testing of the descriptions of parts, introduction of technological and structural monitoring of information files, analysis of the question of expediency of direct formulation of standards and reference data, development of algorithms and programs for rapid information retrieval, development of algorithms and programs to eliminate the use of standard tolerances, development of a set of programs to organize, store and edit output files to allow correction of notations following analysis, development of additional programs to generate equipment lists, operational cards and other documents, and development of a system of programs to calculate tool consumption standards. The basis of the algorithm used is definition of mechanical working operations as an organizational and technological category concentrating treatment of a certain group of surfaces at a single working location with a single mounting of part and adjustment of the tool. The system has been used for design of technological documentation of 8,000 parts manufactured at eight petroleum industry machine building plants. The structure of the system allows further improvement based on experience gained in industrial application of the system.

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REVIEW OF HANDBOOK ON PRODUCTION PLANNING USING AUTOMATED MANAGEMENT SYSTEMS

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 22, No 4, Jul-Aug 1986 pp 755-756

[Review by V.I. Danilin of book "Planirovaniye proizvodstva v usloviyakh ASU (Spravochnik)" [Production Planning Using Automated Management Systems (A Handbook)] by K.F. Yeefetova, T.P. Podchasova, V.M. Portugal, and B.E. Trinchuk, Tekhnika, Kiev, 1984, 135 pp]

[Text] Well-known works on the questions of improving the methodology of planning shed light, as a rule, on individual types of planning under conditions of using automated management systems (ASU's), and give greater attention to the theoretical aspects of the problem than to the requirements of production. At the same time, for the past decade certain experience in employing mathematical methods in planning has been accumulated. For this reason, it has become possible to generalize them and formulate recommendations for ASU developers and economists of industrial plants.

These circumstances make the publication of the handbook under review, which summarizes this experience and is addressed to a wide circle of readers -- "users" of economic and mathematical methods in planning -- very timely. The merit of this book is in its overall consideration of all aspects of planning, beginning with long-range planning and ending with daily-shift planning; accordingly, the book is divided into seven chapters.

Chapter 1 reveals in detail the mathematical methods which are used in long-range planning of plant activity, whose role is constantly increasing in the current stage. Methods of technical and economic calculations, extrapolation methods, multivariate correlation and regression analysis, expert evaluations, and so forth, are presented for implementing long-term planning. Unfortunately, the handbook lacks a description of a large class of optimizing models, based on a normative approach and used during the development of five-year plans. (Footnote) (These models are seen for example in "Ekonomiko-matematicheskiye modeli v sisteme upravleniya predpriyatiyami" [Economic and mathematical models in a system for plant management] Moscow, Nauka, 1983)

The book describes current planning at a plant, its interconnection with the five-year plan and long-range planning, and the models applied in practice (Chapter 2). There is a detailed examination of models for formulating

individual divisions of the industrial manufacturing finance plan, in particular production planning, but at the same time a number of its divisions (for example financial planning) are not at all within the authors' field of vision. The book reflects the experience of the operation of technical and economic planning subsystems at a number of the country's leading plants.

Models for formulating the production program of a plant occupy a special place. For convenience, they are classified according to the types of production, the duration of the product manufacturing cycle, and the conditions for realizing production. However, the classification of these models is not carried out from the standpoint of the factors considered in them, which somewhat lessens the completeness of their description.

Here the data base for the tasks of on-going production planning is characterized. All data necessary for calculating the plan is subdivided into three types: normative; data regarding the possibilities for production in the base period; and the general system data. Principal attention is allotted to the creation of a normative basis for calculating the variants of the plan. This section, in our opinion, is one of the most interesting and useful.

The significance of the normative basis for planning is generally well known. The handbook describes the contents, organization of the on-going renovation, and methodology of deriving each group of norms. The material appears sufficiently general and can provide substantial assistance to designers of on-going planning systems at various types of plants.

The book also looks in detail at operational production planning for them (Chapter 3). It provides a diagram of an operational production planning system, and analyzes in detail the factors which influence the choice of a planning system and the indicators which define the production type. This chapter identifies the place of each model presented in subsequent chapters in the general scheme of operational production planning.

The handbook illuminates the properties of inter-shop planning automation (Chapter 4). The authors present a number of recent, original results: the choice of a planned accounting unit for inter-shop planning, the refinement of the list of its tasks, and the development of their models. Great attention is given to models of this type of planning for various types of production, and to the corresponding standard packages of application programs.

When describing an automated system of intra-shop planning (Chapter 5), the book gives a detailed overview of the tasks of accounting plan structure and analysis and the operational management of the production cycle. Besides the models for formulating a production program and for calendar planning of the work of the sections and so forth, there are also descriptions of the application program packages which implement intra-shop planning.

Special attention is given to problems of calendar planning of production, and to the more typical tasks and algorithms for their resolution (Chapter 6).

Various precedence functions and their classification, proposed for solving the practical problems of composing calendar plans on a computer, are expounded in detail.

In Chapters 4 to 6, models of operational production planning are analyzed, but practically no attention is given to questions of constructing combinations of economic-mathematical models based on them, although this is, at this time, a fundamental direction of modeling planning activity.

The choice of a management subsystem for production engineering and for material-technical supply (Chapter 7) is a definite item of interest. Here the book illuminates the principles of creating adaptive systems of production engineering, and the organization of a planning system and a system for operational regulation of the material-technical supply, but less fully than, for example, the annual and operational production planning. The authors limited themselves to a very compressed list of the most important aspects of modeling these subsystems.

Evaluating the book in its entirety, one can affirm that it has succeeded in systematically presenting a great amount of material about modeling planning activity at a plant, and in combining the necessary theoretical depth with the practical direction of the exposition. In our opinion, the handbook allows one to pick the model (or models) appropriate to every type of planning and choose for it (them) standard software in the majority of cases. The book is well formulated, including a wide list of recommended literature. Undoubtedly it will prove useful to specialists engaged in the questions of planning production.

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NETWORKS

BUDAPEST-LENINGRAD COMMUNICATION CHANNEL

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 14, 22 Jul-4 Aug 86 p 2

[Unattributed article under the rubric: "NTR Pulse"]

[Text] Leningrad cybernetics workers and their Hungarian colleagues are actively cooperating in the area of robotics, flexible automated systems and the development of artificial intelligence.

The computer communication channel between Budapest and Leningrad, operated by the specialists of the Computer Technology and Automation Institute of the Hungarian Academy of Sciences and the Institute of Informatics and Automation of the USSR Academy of Sciences, is a model of future unified computer networks of CEMA country-members.

In the photographs: during one of the Leningrad-Budapest communications sessions. In the foreground - engineer-programmer Olga Smirnova and Natalya Ponomareva, senior scientific associate of the Institute of Informatics and Automation USSR Academy of Sciences; Vladimir Nikolaevich Konoplev, section head of the Institute of Informatics and Automation of the USSR Academy of Sciences. Photographs S. Smolskiy. [Photographs not reproduced.]

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INFORMATICS AND THE NATIONAL INFORMATION RESOURCE

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 5, May 86, p 21

[Article by I. Chebotaru, director of the Republic InterVUZ Computer Center]

[Text] "...The truly new technology of information processing requires new procedures for bringing about solutions... In my opinion, a person who does not want to subject his actions to computer verification does not understand the entire extent of the responsibility which he took upon himself when he became a person responsible for decision-making." (Academician N.N. Moiseyev)

The strategy of the CPSU for accelerating the social-economic development of the nation based on scientific-technical progress presupposes the maximal mobilization of all our material, energy, labor and information resources and reserves. The use of information resources has particular, fundamental significance, as only these, in contrast to material resources, have the unique characteristic of not only not diminishing with intensive use, but, on the contrary, of multiplying.

That is why it was emphasized at the 27th CPSU Congress that computer technology and the industry of informatics, besides machine-tool and instrument making, are genuine catalysts in the acceleration of scientific-technical progress.

At present, informatics is a science concerned with the control of information processes.

If the knowledge a person receives is utilized in bringing about solutions, then it becomes information for him. If this knowledge is not directly utilized in bringing about solutions, but is accumulated for possible use in specific, foreseeable situations, it becomes so-called potential information. Knowledge which is not utilized in adopting solutions and has no foreseeable use, then becomes so-called information "noise." It is impossible to decide in advance whether specific reports or data will become information. That depends upon what the problem to be solved is and for what solution the information will be used.

In order for information to be accepted, it is necessary that it adopt a material form, that it be represented in some information medium. In the

world surrounding us there are many types of information media. For example, air, in the form of sound waves, is a medium for audible information; energy, in the form of electromagnetic waves, is a medium for visual information. Until recent times, the basic long-term medium for information was paper, in the form of various documents, books, etc. Now, magnetic tapes and diskettes are utilized more and more in the capacity of information media. And electronic computers have become the basic instrument for the automation of the processing of information represented in these media. In recent times, these electronic machines have come to be known as computers (from the English word "computer"). In this connection, the process of introducing into the diversity of human endeavor the ways and means of processing information with the aid of computers is now known as computerization.

In the most recent quarter of this century information has become the basic subject of labor for most workers in the most diverse branches of the economy. Information is also the result of their labor. This information is a wealth of a new type: The so-called national information resource.

It is considered that the ratio of the size of the part of the national information resource comprising information used for automated searches, storage and processing to the total size of this resource is one of the essential economic indexes that characterize the effectiveness of the utilization of this most important national resource. Widescale intensification of all types of human endeavor based on the application of scientific-technical results in general, and by means of the computer in particular, facilitates an increase in this index. In this same manner, the computer will become one of the fundamental factors in the growth of labor productivity in the realm of management as well as in the realm of material production. Therefore, information models of production enterprises, associations and entire branches of industry have found wide application in recent years, forming the nucleus of so-called automated information management systems.

To arm man with these fundamentally new means of production, intensifying his intellectual potential, is one of the most important tasks of the modern stage of the development of our society. But wide introduction of computers into the economy must take place in parallel with the education of the population in computer literacy. It is with this aim that this article begins with the new rubric of the journal "The Computer - To Arm the Manager and Specialist." In this journal, we plan to publish a series of articles in which concrete aspects of informatics or the concrete area of its application in the system of the agro-industrial complex will be discussed.

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CSO: 1863/3

HARDWARE FOR AUTOMATED INFORMATION PROCESSING

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 6, Jun 86 p 19

[Second installment of article under the rubric: "Computer - To Arm the Manager and the Specialist," by I. Chebotaru, director of the InterVUZ Computer Center of the MSSR Ministry of Higher and Secondary Specialized Education, and K. Galben, chief engineer of the Project for the Collective-Use Computer System of the MSSR Ministry of Higher and Secondary Specialized Education]

[Text] The utilization of information resources is connected to a growing degree with the effective instrument of information processing, the electronic computer.

The realization of information processing using the computer presupposes the computer's interaction with its human user. The very fact that every computer must be oriented towards a human interface determines all of the computer's characteristics and requires a certain conception of the instrument by the user.

First of all, he must know that every computer consists of separate devices which interact by means of physical connections.

The basic devices comprising the computer are the processor, the main memory and the peripheral devices. Peripherals are divided into external memory and input-output devices.

The processor is a device responsible for the processing of data (information) in a program assigned by the human user. The processor receives the program and the data to be processed in it from its main memory.

Main memory is a device which stores the programs and the data they process. The results of the processing are also placed in main memory.

Peripheral memory devices fulfill the function of a storage place for automatically accessible data, in quantities hundreds of times larger than human memory. Removable data media in the form of magnetic packs or tapes allow the accumulation of archives of data that can be measured in billions of typewritten pages of information.

Devices for the input and output of data are responsible for the interaction of the computer with the user.

At present, basically the following input-output devices are utilized: punch cards, alphanumeric printers, displays and devices for input-output onto floppy disks.

These devices may be employed by the computer in various combinations. But the computer must necessarily contain a minimum of means by which data may be exchanged with the human operator. Today, such a minimal set of devices most often consists of a keyboard, like that of a typewriter, and/or a printer and a video display - a device with a television screen, on which lines of letters, numbers and other symbols are illuminated.

One of the various types of computers is called the personal computer. We would note, and it is important, that this type has all the characteristics of a computer. In particular, the personal computer must have a means for exchanging information with the human operator (today, as a rule, that includes a keyboard and video display, and in the near future a means for voice recognition) and external memory. In the majority of cases in personal computers, cassette tape recorders and floppy disk drives are used as external memory devices.

Everything we have examined until now has referred to the so-called hardware of the computer. However, hardware can do nothing by itself. Another most valuable, inseparable part of the computer is the computer's software. With the aid of software provided with the computer, the user develops specialized software for the solution of concrete technical engineering problems. We will indicate those which refer to the activities of an agro-industrial association.

They consist of managing the technological process of large cattle and poultry-breeding complexes, mixed feed production, greenhouses, enterprises, post-harvest processing and storage of grain, cotton, sugar beet and other cultures, control of water distribution networks, agrochemical information systems, certain structures for the tractor fleet and planning of its use; development of annual and five-year optimized plans, etc.

Thus, automated processing of information with the aid of the computer facilitates the intensification of human endeavor in the realm of planning and management, and leads to an increase in the quality and effectiveness of the accepted solutions.

The stages of solving any problem using a computer will be examined in the next article.

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HOW TO SOLVE A PROBLEM ON A COMPUTER

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 7, Jul 86 p 19

[Third installment of article under the rubric: "Computer - To Arm the Manager and the Specialist," by I. Chebotaru, director of the Republic InterVUZ Computer Center, and N. Galushka, manager of the Computer Center Department]

[Text] Earlier, we spoke of the role of the computer in the processing of information. In this article we will show the stages through which the raw information passes in obtaining the result of the solution of a problem on a computer.

The statement of the problem is the first stage of this process. The goal for the solution of the problem is formulated and its contents are described in detail. The character and essence of all values used in the problem are analyzed, and the conditions in which it is to be solved are determined. The statement of the problem, as a rule, is performed by a specialist in the specific area from which the problem is taken.

Next begins the stage of mathematical formulation of the problem, in which the initial data and the scope of their changes are determined, and the conditions of the problem are described with the aid of mathematical symbols. In other words, a mathematical model of the problem is formulated. The mathematical apparatus to be applied at this stage depends on the type and specifics of the problem. Mathematical formulation of the problem is performed by specialists in mathematics. The practice of problem solving has shown that a greater effect is observed when the first two stages are carried out jointly by specialists in mathematics and specialists in the area of the problem.

Utilization of a specific numerical method leads the solution of the problem to an ordered execution of the four arithmetic actions and logical operations. Therefore, the next stage in the solution of the problem shall be called the selection and justification of the method for the solution of the problem. In denoting the method it is necessary to consider, in addition to the basic requirements of the problem, the precision of the computations, the computer time for the solution of the problem, etc. In some cases, the suitability of the chosen method may be established only in the later stages. When the

chosen method is revealed to be unsuitable, it is necessary to return to the stage of selection and justification of the method. This stage is to be carried out by the specialist in mathematics.

The next stage consists of composing the algorithm for solution of the problem. The process of treatment of the initial information is broken up into independent elements for computation, and the sequence for their computation is established in accordance with the chosen method. In order to reveal the interconnections of these elements, an algorithm is worked out for the solution of the problem. At this level the correctness of the algorithm is verified to be within the possible limits of logic. The work in algorithmization of the solution of the problem is performed by programmers.

Next is the stage of composing the program - the algorithm for the solution of the problem described in a language understandable to the computer. Such a description of the algorithm is translated to one of the programming languages with the aid of specialists in information media systems (punched cards, punched tape, magnetic tape or magnetic disk). The algorithm for the solution of the problem, described in the programming language and transferred to an information medium, may now be employed for development on the computer.

Developing the program on the computer pursues the following aims: control of the program, and detection, determination and correction of errors. The elimination of incorrect elements in the program is called debugging. Large programs are divided into parts, with as few connections between them as possible. The correctness of the computation is verified separately for each part. That is, so-called autonomous debugging is conducted. After the errors are eliminated, the program is debugged in whole: Several examples are worked through in this manner, in order to verify that the separate parts of the debugged program work together. This is a labor-consuming stage, in which the programmer's first commandment should not be forgotten: "Every last error found is really the next-to-last."

After debugging the program, and after preparation and verification of the initial data comes the stage of solution of the problem on the computer.

Solution of problems by computer takes place automatically after loading the program and the initial data into the computer. However, during the solution of the problems, the operator must be present at the console, as he can interrupt the operation of the machine if unforeseeen or impermissible situations arise. The operator follows instructions set forth in advance by the programmer - the developer of the program.

The results obtained in solving the problem on the computer are analyzed and evaluated by the specialist who had stated the problem jointly with the mathematician and programmer.

Examples of solving concrete problems from branches of the economy will be examined in subsequent articles.

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PROGRAMMING SCHOOL

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by G. Grigas, candidate of technical sciences, and V. Dagene, scientific associate; first paragraph in source in italics]

[Text] Many graduates of the correspondence "Young Programmer's School," organized by the Mathematics and Cybernetics Institute of the Lithuanian AN [Academy of Sciences] and the republic youth newspaper, have become quite friendly with computers.

The "Young Programmer's School" (ShMP) is open to all interested persons. There is a large number of them, as practice has shown: In each group there are 1,500 people, the majority of whom are in republic high schools. They take an active part in solving problems assigned through the newspaper. In correspondence programming courses we are striving to provide the necessary knowledge in this discipline, to develop skills in algorithmic thinking and to teach an approach to creating programs which solve simple problems. Preference is given to practical questions, as our students acquire theoretical knowledge in the process of generalizing practical assignments.

Programming instruction at ShMP is divided into two parts: programming principles, to which 6 months are allotted and programming basics, to which 18 months are allotted.

Programming principles is a survey course designed to familiarize all students with programming. This course's lessons are published in the republic "Komsomolskaya Pravda" from September to December, one lesson per week. Students are given four to five graded assignments, each containing three problems. Each assignment is to be completed in one week.

Programming basics is a more fundamental study of the discipline. Those ShMP students who have successfully mastered programming principles may enter this course. The course materials and assignments are mailed out each month. In all, 12 graded assignments are given for completion in the programming basics course.

To aid students, the ShMP has developed and published course materials: instructional materials, problem sets and a manual on the Pascal language.

Each year we organize summer camps and meetings in various cities of the republic for our students. Olympics are held and there are contests for the best program for one's own problem.

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'PYRAMID' MICROCOMPUTER FOR TRAINING

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by S. Pavlova: "The Universal Pyramid"; first paragraph in source in italics]

[Text] An original training computing complex has been developed by Moscow Institute of Electronics Technology teachers and students.

"The basis of our 'Pyramid' is a training microcomputer housed on one open board," relates D.I. Panfilov, candidate of technical sciences and docent of the Electrotechnology Department, one of the initiators and authors of the design.

Additional boards, each of which performs a specific function, go into "Pyramid." Board construction is also open, so any of them can be the subject of separate research while operating in conjunction with the microcomputer. "Pyramid" has yet another property: It can be disassembled. All the circuit boards are easily joined with each other. Consequently, some can be removed and, when necessary, replace others. In other words, just as it is possible to construct little houses of varying architecture from nursery building blocks, it is possible to "assemble" a microcomputer from a selection of electronic boards with varying designated properties. In point of fact, at the basis of "Pyramid" is the ever-familiar operating principle of nursery construction which, for all its fascination, is still an exceptionally useful game, developing expression and independent thought and revealing individuality and a proclivity for creativity.

The complex is not called "Pyramid" by chance. Knowledge of what is new proceeds from day to day, from foundation to summit, from the simple to the complex. With its help, it is possible to learn circuit features and the software of microcomputer systems, to master practical methods of detecting faults in the device and to learn to model the operation of different units. Moreover, "Pyramid" can work as a control panel for very different devices: a television, common tape recorder, display and plotter or robot unit. Joining the computer with any peripheral device is done through the so-called interface unit, which can also be removed if necessary. In one word, "Pyramid" is universal--invent, create!

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COMPUTER USE IN TEACHING SOCIAL SCIENCES URGED

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 12: TEORIYA NAUCHNOGO KOMMUNIZMA in Russian No 4, 1986 (received by editors 31 Mar 86) pp 55-61

[Article by T.V. Belova: "Computers in Teaching Scientific Communism"]

[Text] The basic directions of the country's economic and social development over the current 5-year period and over the period up to the year 2000 has set the task of "substantially improving the supply of up-to-date instruments, equipment, automation equipment, and computers to organizations and higher educational institutions."[1] There is much yet to be done even in this direction. The introduction of computers into all spheres of the life of society is an important feature of the scientific-technical revolution we are experiencing. The dissemination and widespread assimilation of computer technology and the gradual transformation of computers into an everyday phenomenon constitute an invariable condition of the intensification of all social processes, including the process of teaching in higher education. Step-by-step computerization has become an integral part of the reorganization of higher education and of improvement of the training of future specialists.

There are, of course, a number of reasons why computerization cannot take place at anything like the same rate in all higher educational institutions. Compared to the natural and technical sciences, the humanities do not lend themselves so well to formalization, to quantitative description, and probably not to the fast and broad application of computers either. Moreover, established traditions in teaching are also an obstacle to a certain extent to application of advanced achievements of science and technology to the teaching process.

At present scientific-technical progress is influencing courses in the social disciplines, scientific communism in particular, along just one line: examination of the nature, historical role, and consequences of the scientific-technical revolution is a subject taken up under certain topics. This direction in teaching should clearly be improved still further. Yet, as emphasized in the new version of the CPSU Program, the scientific-technical revolution is having a powerful impact not only on present-day production, but indeed on the entire system of social relations, on man himself, and it is opening up new prospects for a substantial rise in the productivity of labor and for progress of society as a whole.[2] It follows therefore that the NTR should be not only

a subject of study, but also a teaching tool, the means of achieving higher effectiveness of all forms of teaching, of improving the quality of assimilation of knowledge by students with a smaller investment of time.

The present-day situation in the flow of information in the social sciences is characterized by very rapid change in quality and quantity. Some people refer to this situation as the information explosion, others as the information crisis, and still others as the information revolution. But whatever name is given to this phenomenon, one thing is clear--it is difficult even for a specialist to get his bearings in the flow of so much information, not to mention a student. Accordingly, a different level of control over the process of the inflow of knowledge in the social sciences is demanded of personnel in higher education, social scientists first of all. We are referring not only to a change in teaching style and methods, but in fact to a transformation of the very character of the educational process on the basis of recent advances of science and technology. As computers make their way into all spheres of human activity, working major changes in the content and character of work, they offer immense opportunities for the process of teaching related to the sciences which embody a world outlook. Today the computer is taking on an active role in the academic high school. In the light of the requirements of the reform it is bringing about a fundamental change in the quality of its performance, the students themselves are active in acquiring knowledge, it is speeding up the pace of thought considerably, and it is saving the time and energy of schoolchildren in satisfying their intellectual needs and enthusiasm.

The times demand a qualitative improvement of teaching in higher education as well. The task of personnel in higher education is not to trust exclusively in recommendations from above, but to take advantage of the strategy offered by the party, the strategy of large-scale experimentation.

In our view it is permissible to use computers in teaching on the basis of critical analysis and foreign know-how. We cannot, of course, merely copy the tricks, falsifications, and other con men's deceptions practiced by bourgeois propaganda. It is important to make use of what can "work" to our interest.

The use of computers in teaching the social sciences is something inevitable. You sometimes hear the expression: "What is there to talk about unless we see these machines with our own eyes?" First of all, computers do exist in a number of VUZ, including MGU. Second, where they do not exist as yet, people should be ready to encounter the computer. And this preparation must be made both through familiarization with the computer, with the way it is made, through an introduction in the form of a seminar required for social scientists who teach the course in informatics, as well as by teaching programming. It would seem that the method of programming without the computer, which has been proposed by the secondary school system, opens up large opportunities for elementary training for interaction with the computer. This method also holds promise for VUZ teachers. It meets the requirement which was advanced back at the June (1983) Plenum of the CPSU Central Committee--of "accomplishing the broadest use of computers."[3]

As in any new thing, the two extremes are undesirable here: exaggerating the role of computers in the educational process, and, conversely, conservative nihilism in their use. Of course, one cannot concur in the view which is widespread in the West that teaching is undergoing radical modification in the present world, that the "conventional system based on classroom exercises and personal involvement of the teacher will be replaced by programmed learning accomplished with an entirely informatized system."[4] Even where the necessary physical facilities are in place, computerization must take place gradually, adjusted to the particular teachers of the topic outline of the course in scientific communism. A thorough analysis is needed as to what aspects of the topic being studied can be turned over to a machine that does the teaching and the checking. To lose a sense of measure threatens a game of definition, the substitution of freewheeling operation with the set of categories, stochastic schematization.

Use of the computer presupposes a step beyond the customary ideas about the teaching process. Here the number of work stations connected to the machine may be large, and the questions put to each user may be individual. The automatic teaching machine is far more patient than the teacher, and the learner becomes less upset when he makes a wrong answer. The computer can impart a large amount of sound knowledge to students. That kind of advantage is very important, since man's present-day development demands that an ever larger quantity of knowledge be accommodated in an ever smaller quantity of information. One can therefore forecast that the traditional textbook will come to the end of its usefulness as a means of learning in the era of the scientific-technical revolution.

Computerization in scientific communism results in a change in the forms of the teaching effort. The teacher will be freed of numerous repetitions, he can lead the discussions instead of repeatedly listening to correct and incorrect answers. As it changes the techniques of data processing and data acquisition, the computer will stimulate the research effort of teachers to compile saturated teaching syllabi.

At the same time we must also take into account the computer's capabilities. For instance, its ability to analyze new incoming information is limited. For example, the less familiar the situation is to the computer, the less reliable its answers, the more identical information it will accumulate and the more stereotyped its forecasts and recommendations will be. The computer also has another shortcoming--the inability to determine the content of new incoming data with sufficient reliability. As a result its memory inevitably becomes cluttered with superfluous information, and yet the computer is unable to realize that this information is unnecessary and sometimes even harmful. We should also remember that the computer is only a tool of man's intellectual action. Bad teaching programs will not be beneficial, but will be harmful; they could result in a standardization of thinking. The computer replicates the teacher's skill by including his knowledge and professional experience in the knowledge base. That is why it is so important here that the computer be introduced into the teaching process by stages. We need to be clear on the point that it is not the computer that defines man's world outlook; it is possible to gain knowledge with its help, but no more than that. Building a man's

character, shaping his convictions, the evolution of his moral and political positions are achieved mainly on the basis of the teacher's live intercourse with the student on the basis of confidence. Only in that way does the student come to the point of independently building himself.

The computer affords the teacher the possibility of broadening the framework in which problems are studied, of imparting to the students a greater interest in acquiring knowledge. This motivation occurs on the basis of the teacher's examination of the problems that exist, the contradictions in social development, and a presentation of the directions of the scientific exploration to resolve them.

The use of computers must comply with the humanistic parameters of values, the ethics, and the rights and duties of man in a socialist society. For example, N.N. Moiseyev, member of the academy, and I.T. Frolov, corresponding member, emphasize, for example, that "the new means of transmitting and analyzing information may prove to be a key to executing programs for restructuring a man's scale of values."[5]

The possibilities for the use of computers in teaching the social sciences are based on the most characteristic attributes inherent in present-day computers. The essence of them lies in the following: 1) in the possibility of timely and effective use of present-day information on the basis of the speed characteristics of the computer; 2) in the ability to "play out" logical problems by using a proposed model, the ability to reproduce differing points of view, to find the right answers by checking the proofs.

Two directions for applying computers in teaching scientific communism and other social science disciplines follow logically from the capabilities of the computer enumerated above. The first direction gives to the computer the role of an information and consulting service. Something can be learned here from the experience of the Fundamental Library on the Social Sciences, where a state data bank making it possible to use a computer catalogue is being set up. VUZ's which have the physical facilities for computerization plug in to the information service system. For instance, the Moscow Physical Engineering Institute is making a vigorous effort to involve the terminal information system connected to INION in the practical work with students. Any teacher, associate, or student can in a few minutes obtain information on the literature available on each of the topics being studied and on the basis of that communication will have a printout at his disposition. To be sure, many people still have to resort to the services of the engineer attending the terminal information system for the social sciences (TITsION). There is a need, then, to develop informatic literacy in computer users. This will be greatly furthered by the course in informatics taken by teachers of the social sciences, by workshops in mastering the skills of operating computers. Many social science teachers are working out projects for consultations on particular topics in the syllabus. During such a consultation the computer can convey to the students the main body of knowledge and conclusions which are not subject to discussion and which for one reason or another have not been previously assimilated by the students.

The second direction for the use of computers is to create learning programs on the basis of a data bank. It is clear that the computer itself does not select from textbooks the body of knowledge which it furnishes. The computer accomplishes the acquisition of knowledge in a network of connections between the principals. Here one of the principals is the student, who clarifies the internal dependent relationships of the proposed phenomenon, and the other is the teacher, who proposes the information bank. As is well known, information is knowledge obtained on the basis of data. It is the teacher's job to process the data, which means putting it in the form that is most suitable for the information to be extracted from it. Moreover, the maximum information should be extracted from a minimum amount of data. Data banks pass through a triple filter in order to be perceived and to become information: a physical filter (constraints on the throughput of the channel), a semantic filter (brief, straightforward, and very limited sets of terms, creation of model, standard thesauruses), and a pragmatic filter (appraisal of the usefulness of the data).

It is thought by some that social phenomena cannot be placed in the framework of structures in formalogic and abstract mathematics, in tables, and matrices. This assertion is too categorical. V.Zh. Kelle proposes that the way out of this be "sought by differentiating the different types of social knowledge, specifically distinguishing between knowledge of the social humanities and social knowledge."[6] The latter in his opinion is closer to natural science, although it does require an appropriate qualitative interpretation in order to clarify the social meaning. Quantitative methods, formal diagrams, and abstract models play a subordinate and auxiliary role in the former meaning of the term. In its reliability and strict causality of clarification and forecasting a social science does not fall short of the precise sciences.

The essence of programming social knowledge consists of presenting the subject matter not in a stream of information, but in arranging it into steps. In answering successive questions the student reaches the conclusion on his own.

The large number of problems and exercises in the social sciences which have now been proposed and which have been published in many VUZ's can serve as the base that is necessary for programming. The problem consists of conceptualizing the experience, of distinguishing the key questions which run through all the topics in the course on scientific communism. The problems to be clarified and selection of the right solution can easily be adapted for use on computers. Many people rightly feel that in view of the emergence of a large number of different collections of problems and exercises there is a greater need for psychological-pedagogic analysis of the practice of their use in teaching.[7] Moreover, a mathematical-cybernetic analysis is also indispensable when teaching machines are used. Constant communication with the engineering departments needs to be established, and a laboratory set up that will bring together social scientists, engineers attending the computer, and mathematician-programmers.

Teachers of the social sciences will have a larger role to play in preparing the program as the use of computers in teaching expands in the future. The effort in that direction should begin even now. In our view it would be

advisable to this end for the Ministry of Higher and Secondary Specialized Education to set up a center that would coordinate the activity of social scientists in writing programs in the social disciplines.

Competent specialists should be enlisted for this work. After all, the programs must be saturated to the limit with information. What we are actually talking about is the problem of building a model of the course in the various social sciences. Building a model of a particular topic presupposes aggregation and unification of related elements to form larger units. At this point it would be up to the specialist to decide which of the elements of knowledge are the most important. Although such a model can give only an approximate description of the process being studied, the aggregation is indispensable. Once created, the model would not correspond to the original in general, but with respect to those of its characteristics which are the most important for the researcher. For instance, building a model of the topic devoted to the theory of the socialist revolution, to the content of the present era, requires aggregation of the principal component determining the nature of such a revolution and the basic content of our era.

One of the goals of computer teaching is for the students to assimilate normative (prescriptive) models of responses designed for attainment of the optimum state of the total body of knowledge. In this case we get a closed model which seems to be isolated from the environment. It may be only a scientific abstraction that helps in studying the patterns of a real society in accordance with a simplified version. The behavior of such a model is determined not by external factors, but by the initial state and internal patterns of its development. That kind of isolation is, of course, very hypothetical; as a matter of fact the system is always open because of the universal interconnectedness of social processes. And that is why it would be a mistake to reduce the program of work on teaching machines to the assimilation and free handling of normative models. The latter can and should be fitted into an explanatory scheme and supplemented with descriptive models which analyze the facts. The optimum version of an explanatory scheme is found by "capsulizing" the specific features of a particular piece of knowledge in its abstract-logical forms. The explanatory scheme is a reliable guarantee of the objective truthfulness of the model. For example, the fight for democracy as an integral part of the fight for socialism might be represented in the form of an explanatory scheme. Such a model would include definition of at least three elements of objective processes: 1) the basic content of the fight for democracy; 2) the connection between the fight for democracy and the fight for socialism; 3) the insufficiency of the fight for democracy for the purpose of establishing socialism. The normative model is assimilated more firmly, and the knowledge becomes more dynamic, if criticism of non-Marxist models of the fight for democracy from the standpoint of the prospects for socialism is given as the second assignment. The purpose of this kind of study is a thorough understanding of the inadequacy of the fight to establish democracy for the purpose of establishing socialism, the inevitability that adherents of conceptions of "democratic socialism" will slip back to a policy of reconciliation with the existing political system of capitalism.

The process of computer-aided teaching goes like this: The teaching machine displays a brief instruction and puts a question. The user selects one of the proposed answers or fills in blanks in the text. The computer evaluates the correctness of the answer. If it is wrong, then the computer either takes the user back to an earlier stage of learning or gives the correct answer. When computers like this are used, a distinction should be made between the putting of a question as part of the teaching process and putting it at the end of the process. In the former case the user, relying on material already learned, should by logical conclusions find the correct answer with the computer's help, while in the latter case this material serves only to reinforce the knowledge acquired. Depending on the programs used, these computers can be divided into two types: the first type uses linear unbranched programs whose course the user cannot influence. He is asked to choose one of several alternatives from a set of those which are possible. Making a decision requires clear formulation of the objective, compiling a list of alternative possibilities and defining the rules governing choice among them, and knowing the factors which can influence the result of the taking of a particular decision. The difficulty here is that this kind of situation may be grasped not as the result of analytical scanning of the different versions with respect to the objective, but as the result of synthetic insight, a sudden intuitive grasp of the idea behind the decision looked for. Electronic cheating, which has been quite often observed in the West, is also possible here.[8] Knowing how a program operates, certain users who know about computers determine the position of the correct answer and use it for their own purposes. That is why problems involving choosing the correct answer from several that are proposed cannot be a form of learning, but figure only as a way of testing existing knowledge. At the same time, every student can check his knowledge of topics studied previously.

The second type of program is one that is branched, so that if the user does not find the correct answer, the program branches, and that makes it possible to fill the gap in his knowledge. The student using this type of program conducts what is called genetic analysis; that is, he examines the process from the standpoint of its occurrence and development. This gives the students greater interest in the problem area being studied. The exploratory and creative factors in learning are broadened by means of the computer, and individualization of learning exercises is achieved. Branched programs presuppose that clarification of the topic is both complete and comprehensive, and they require not separation, but unification of the philosophical, sociopolitical, historical, and economic aspects of the problem area being studied. They create the prerequisites thereby for eliminating duplication in the teaching of the social sciences.

Teachers of all social science departments must take part in writing the programs for teaching machines; that is, interdepartmental integration is indispensable here.

Thus the new teaching technology inevitably involves intensification of teaching activity and alters the forms which social scientists use in their work. By broadening the forms and methods of teaching, the computer raises the issue of the increased role of the social scientist's personality. Unfortunately,

little attention is still being paid to the teacher's ability to participate in arguments, to be convincing, to get his bearings in the things that particularly interest and excite young people. The times demand a greater general sophistication and erudition on the part of the teacher, and ability to respond to many questions, including those which lie outside the limits of the subject.

In summing up what we have said, we should note that reality is urgently and irrepressibly demanding that the reorganizational and methods aspects of teaching be revamped and refined and that these efforts keep pace with scientific-technical progress. There are, of course, difficulties along this road, including difficulties in the area of computer application to teaching the social sciences. On the one hand they have to do with the fact that the computer is still not reliable enough and there has not been enough experience in operating it and taking care of it. On the other hand, social scientists are still not mentally ready to use the new technology. The very posing of the question of using computers in teaching arouses internal resistance on the part of many people. That is why we need a psychological reorientation here above all. The problems of a radical restructuring of syllabi, of reassessing the teaching load on teachers, and of changing the style of leadership of academic departments are also being put on the agenda.

"Scientific-technical progress," it was emphasized at the June conference (1985) held in the headquarters of the CPSU Central Committee, "is a vitally important phenomenon; it responds to the interests of all and makes it possible for everyone to discover his abilities and talent on a broad basis."[9] This also applies to VUZ's. It seems to us that the leading VUZ's of the country, MGU first of all, must design and conduct well-thought-out and substantiated experiments in the use of computers in teaching. The favorable results obtained in the process of such experiments will provide the basis for major transformations in teaching scientific communism.

FOOTNOTES

1. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza" [Materials of the 27th CPSU Congress], Moscow, 1986, p 284.

2. Ibid., p 141.

3. "Materialy Plenuma Tsentralnogo Komiteta KPSS, 14-15 iyunya 1983 g." [Materials of the Plenum of the CPSU Central Committee Held 14-15 June 1983], Moscow, 1983, p 10.

4. Quoted in G.Kh. Shakhnazarov, "Kuda idet chelovechestvo" [Where Is Humanity Headed], Moscow, 1985, p 73.

5. VOPROSY FILISOFII, No 9, 1984, p 26.

6. "Teoriya otrazheniya i obshchestvoznaniye" [The Theory of Reflection and Social Science], Sofia, 1973, p 259.

7. "Problemnyy metod prepodavaniya nauchnogo kommunizma" [The Problem Method of Teaching Scientific Communism], Moscow, 1984, pp 100-101.

8. FILOSOFSKIYE NAUKI, No 2, 1984, p 65.

9. M.S. Gorbachev, "Korennoy vopros ekonomicheskoy politiki partii" [The Fundamental Issue in the Party's Economic Policy], Moscow, 1985, p 31.

7045
CSO: 1863/64

NEW JOURNAL 'INFORMATICS AND EDUCATION' PUBLISHED

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 19, 7-20 Oct 86 p 2

[Article by S. Khozin: "To the Teacher and the Student"; first paragraph in source in italics]

[Text] The first issue of the journal "Informatics and Education" has appeared.

Today's students will arrive tomorrow at the laboratory and workshop where contemporary computer technology awaits them. The computer will arrive in the school in the next few years. Confronting Soviet teachers is the task of introducing into pedagogical practice a new course on informatics and computer technology within a short time. The basic task of our publication is to aid teachers in its solution.

These words of Academician V.A. Melnikov, pronounced at a meeting of the editors with readers--the teachers of the Moscow Oblast--sounded like words to launch the new journal "Informatics and Education," the first issue of which recently appeared. It is published by the USSR Ministry of Education, the USSR State Committee on Professional and Technical Education and the USSR Ministry of Higher and Secondary Special Education. Two more issues will appear before the end of this year. In the future, readers will receive it every two months.

Almost 130 pages, each of which helps the teacher, the student, and the scientist--this is no insignificant size. The first issue opened with an article by the USSR Minister of Education S.G. Scherbakov and included the columns "General Questions," "Instruction Methods," "Computer Technology Classroom," "The Computer in the National Economy," "Foreign Experience," "Information Technology Dictionary" and others.

The journal broadly illuminates the issues of information technology teaching practice in schools, SPTU [Professional-Technical Secondary Schools] and technical high schools, and the questions of school classroom equipment and making the new technology operational. Programs for the school computers are not forgotten. Article authors give program descriptions and methods for using them.

The journal should become a reliable aid and faithful friend to the teacher and should also find its fans among parents and, of course, students.

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SIXTIETH BIRTHDAY OF VLADIMIR MIKHAYLOVICH KUROCHKIN CELEBRATED

Moscow ZHURNAL VYCHISLITELNOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 26, No 6, Jun 86 pp 803-804

[Anonymous article saluting the 60th birthday of a prominent Soviet information scientist]

[Text] June 1, 1986, is the 60th birthday of the prominent Soviet information scientist and head of the program systems division, Computer Center, USSR Academy of Sciences, Vladimir Mikhaylovich Kurochkin.

V.M. Kurochkin started his scientific career as a mathematician-algebraist in the mechanical-mathematical faculty of Moscow State University. He published a series of works on the theory of rings and algebras.

Since 1950, working in the Institute of Precise Mechanics and Computer Technology, USSR Academy of Sciences, V.M. Kurochkin has taken an active part in the development of a command system for the BESM, one of the first Soviet computers. For this work V.M. Kurochkin was awarded the Order of the Red Banner of Labor.

Later, V.M. Kurochkin was occupied with programming, at that time a new area of science.

In 1955 the Computer Center, USSR Academy of Sciences was created, and V.M. Kurochkin became head of the programming laboratory. In addition to works on automation of programming, the laboratory carried out important computer projects. Soon the laboratory became one of the programming centers in the USSR. In the following years several groups split off, forming the nuclei of other divisions in the Computer Center and also in other institutes (Computer Center, Siberian Section of the USSR Academy of Sciences and the Central Economic-Mathematical Institute).

V.M. Kurochkin became one of the first in the USSR to work on the automation of programming. In years when the reliability of the vacuum tube computer was extremely low, the possibilities of linking computers with the external world was at the level of a computational-analytical machine, V.M. Kurochkin headed work on the creation of a programming program, and as a consequence, the languages of programming and translators. The developers of these

programs had to struggle with colossal difficulties, and it was necessary to keep a clear perspective to overcome them.

Under the direction of V.M. Kurochkin the PPS translator was created for the Strela-3 computer, as was a translator from the ALGOL language for the BESM-2 computer. Following this, V.M. Kurochkin put together the original, widely-used "Compiler and Interpretive System" (CIS) for the BESM-2 computer.

V.M. Kurochkin made a large contribution to programming languages. He was an active participant in the international group on automation of programming which developed the language ALGAMS.

Under the direction of V.M. Kurochkin, at the Computer Center, a translator for the ALGOL 60 language was created for the BESM-6, which to this time remains one of the most important software components of this computer.

Work on translators naturally attracted the attention of V.M. Kurochkin to the automation of their development and to formalization of the description of programming languages. On the basis of this formalization, the apparatus of attributive grammars was proposed. The attributive grammars were generalized, permitting use of their greater effectiveness for defining the programming languages. V.M. Kurochkin proposed an original asynchronous computational algorithm for the semantic attributes.

Since 1948 V.M. Kurochkin has led pedagogical work in the Moscow Physical-Technical Institute. He developed university programs in computer software, linear programming and translation methods. Lectures by V.M. Kurochkin smoothly combine the mathematical bases of programming and practical achievements.

Many Soviet programming specialists consider themselves students of V.M. Kurochkin. People working alongside him know him not only as a specialist with exceptionally great prestige, but also as a sensitive and attentive person. Under his direction many dissertations were completed in the area of implementing programming languages and on the theory of programming.

V.M. Kurochkin is of great service in disseminating scientific knowledge. He has been a member of the editorial committee of our journal from the day it was founded, and editor and translator of several editions.

V.M. Kurochkin was at the foundation of Soviet programming and today continues active creative work.

We salute Vladimir Mikhaylovich Kurochkin on his 60th birthday and wish him excellent health and further creative successes.

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CONFERENCE ON AUTOMATIC CONTROL

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 20 Sep 86 p 3

[KazTAG report: "Scientists--To the Matter of Control"]

[Text] Every three years the USSR National Committee on Automatic Control, in conjunction with the leading scientific organizations of the country, holds an All-Union conference on problems of control in different branches of the economy. It is convened in the year preceding the regular congress of the International Federation on Automatic Control in order to present at it the most promising reports. Such a conference opened on September 29 in Alma-Ata. Here, more than 1,000 specialists from 70 cities of all the union republics represent the scientific-research institutes, association construction bureaus, factories, plants and institutions of higher education.

The text of the opening address of the organization committee chairman, Academician V.A. Trapeznikov, which Professor N.A. Kuznetsov read aloud, stated that fulfilling the program of intensive development and acceleration of scientific-technical progress adopted by the Party requires a more active introduction of science and a close cooperation between science and industrial enterprises. The president of the Kazakh SSR Academy of Sciences, M.A. Aitkhozhin, addressed greetings to the conference participants.

In the first place, for what kind of practical problems is it possible and necessary to achieve the largest impact. Which problems, given this, must be solved. Of the accumulated experience, what holds promise for the future; what has become obsolete. These and other questions will have to be decided.

The deputy chairman of the Kazakh SSR Council of Ministers, M.M. Akhmetov, the leaders of the Kazakh SSR Academy of Sciences and a number of ministries and departments of the republic and party and Soviet workers were present at the opening of the conference.

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Conference on Interactive Multi-Terminal System

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 20 Sep 86 p 3

[KazTAG report: "Interactive Session With a Computer"]

[Text] The process of computerizing management in a period of reorganizing the economy is playing an ever greater role. It allows specialists to dynamically analyze the production situation and to make prognoses on the development of events and to work out alternative operative solutions with an evaluation of their economic expediency. But, in the conditions which have arisen of creating large-scale processing centers, methods of working with computers are still labor-intensive, especially in programming and debugging the corresponding programs. This process takes an unjustifiable amount of time. And, most essentially, work with a computer requires the presence of highly qualified programmers while excluding, for all practical purposes, the possibility of on-line intervention by the user in the solution of one problem or another.

The republic conference-seminar "Experience of Applying the DIAMS Operating System in the Economy," which opened on September 29 in Alma-Ata, was dedicated to questions of more intensive utilization of computer intelligence. It was held by Gosstroy [State Committee for Construction Affairs], the Kazakh SSR Minmontazhspetsstroi [Ministry of Assembly and Special Construction Projects] and the republic governing board of the construction industry NTO [Scientific and Technical Society]. The speeches by Ye.G. Yezhikov-Babakhanov, the Kazakh SSR Minister of Assembly and Special Construction Projects, by G.P. Ostapenko, department head of an Institute of the USSR Minpribor [USSR Ministry of Instrument Making, Means of Automation, and Control Systems], and by others noted that the wide application of the interactive multi-terminal system (DIAMS) can promote a better utilization of a specific class of computers. Putting it into operation at the administration of the South-Kazakhstan "Kazkhimmontazh" trust has already yielded a positive result. The exchange of opinions at the seminar-conference will aid the development of an effective technical policy in the utilization of processing technology.

Specialists and scientists from a number of union republics took part in the work of the seminar-conference.

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USSR Report

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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2 APRIL 1987

USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

CONTENTS

/13046

SOFTWARE

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USE OF PROTOTYPE PROGRAMS IN MODIFICATION OF ASU SOFTWARE

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 39-41

[Article by Engineer S. V. Yakovlev]

[Text] Data processing in an automated management system should support a specific level of reliability so that the resulting data of computations be reliable, of high quality and so that they can be presented within the planned deadline. Rigid time restrictions for timely correction of errors in software (PO) are necessary in data processing in this regard.

The programmer's reaction time to an error should be rather short, since otherwise the planned deadline of computing a task is disrupted and trust in the IVTs [Information Computer Center] is lost on the part of plant services and plant management.

Systematic modification of programs during operation of the system results in the fact that essentially all programs are modified. Since each programmer introduces his own programming style in the fragment of software to be modified, each subsequent programmer must comprehend the coding characteristics of both the program author and of all the predecessor programmers. It is obvious that this is not a simple task and requires good skills. However, the more interesting work usually attracts highly skilled personnel to design organizations. Therefore, programming aids must be developed that permit the maintenance programmer to form his job within established deadlines with a guarantee of software quality, regardless of his skills.

The existing aids for software development (RTK, PRIZ, MARS, SPORA, APROP, YaUZA and so on) are oriented toward the skilled programmer and are designed for the production of large programming complexes; therefore, they are very rarely used in plant information computer centers.

The lack of a method for making modifications in software gradually reduces its quality (speed is reduced, the main memory capacity is increased and the recognizability of programs deteriorates), which in turn delays the increase of savings from introduction of the automated management system even under conditions of constant and specific improvement. According to the estimates of leading specialists, program maintenance of software is the most important

phase in the life cycle of programs and requires up to 80 percent of the total expenditures for programming. (Footnote 1) (R. Glass and R. Hause, "Soprovozhdeniye programmnogo obespechniya" [Software Maintenance], translated from English, Moscow Izdatelstvo "Mir", 1983, 158 pages)

Modification of software can conditionally be divided by the scale of changes into functional and operator modification: functional modification is achieved at the level of individual functions, which provide for removal, supplementation, replacement and changing of the sequence of executing the functional modules. A new sequence of modules, combined by one or several control modules, is sometimes added to existing software. This modification is in fact development, but its scales are limited.

The effectiveness of functional modification depends on the extent to which the software can be broken down into modules during initial development. Operator modification is performed within an individual functional module, while correction concerns individual operators or a sequence of them. The simplicity of modification in operator modification is dependent on the architecture of each program module individually.

However, the modular nature of software alone and the use of structured programming procedures in working out programs cannot guarantee speed in modification of them, since different programmers, each in his own way, interpret the situations of these fundamental concepts, while the final product of their activity reflects to a significant degree the individuality of the developer. Additional methodical propositions, software and organizational media are required to implement effective maintenance. The experience of software maintenance of automated management systems indicates that methods of implementing this task should meet the following conditions: maximum orientation toward the stereotype nature of modules, the capability of using production procedures of programming both in working out the new programs and in maintenance and guaranteed recognizability of the programs regardless of the personal characteristics of the programming style.

Regularity in programming is very important and real programs should be represented by stereotype (frequently repeated) fragments. Analyzing the structure of the stereotype fragment, one can determine its components, i.e., other subordinate stereotype fragments, and one can identify them for determination of the roles which the components should play with respect to the initial situation.

A simple and rather expressive form of implementing the programs of automated management systems is to work out and modify them on the basis of semifinished-blank programs. These blanks, so-called program-prototypes (PP), are the basis for future program modules.

The prototype program is a module that implements earlier determined functional processing of information and which permits step-by-step descending development of the program by disclosure and detailing of bottlenecks. This approach concentrates attention toward a partially completed program and permits one to investigate more fully the software fragments. If the program module is implemented on the basis of a prototype program, modification of it reduces to

modification of individual fragments and these fragments are not difficult to determine, and by taking into account the independence of procedures that implement these fragments, one can make changes in phases and independently one from another.

It is recommended that the existing operators of the initial text reconfigure the programs to prototype program procedures and then make the modification only when modifying already existing software, implemented without the use of prototype programs. Universal liberation of elementary, repeating fragments of programs is the main thing, which may improve the working efficiency of programmers.

The prototype program is a means of recording the experience of previous work in programming. The infrequent programmer writes the program, being guided only by postulation of the task. The design elements of programs, already checked in practice by the programmer himself, are usually employed actively in programming. If personal experience is insufficient, the structures of programs that implement similar algorithms written by his colleagues are analyzed and borrowed.

In making a decision in a specific situation, the programmer compares this situation to his own experience, analyzes it and selects the method of actions, which were successful in the past. The experience of previous developments is implemented in the prototype programs. Many data processing situations were taken into account in the same manner, which considerably reduces the information load of both the program developer and of the attendent programmer. Everything that is subject to formalization in the data processing algorithms should be reflected in the designs of prototype programs.

Analysis of the ASU software made it possible to determine that 80 percent of the functional modules can be related to different groups of programs, having similar design (within the group), for which development of the prototype program is possible. The basis of this grouping of ASU software is determination of the main operations on data sets, i.e., selection, compression and joint processing of files, printing and sorting. Each of these basic operations are primarily divided into operations with narrower specialization. For example, detailing the access operations permits one to determine the following versions (Footnote) (V. M. Glushkov, A. V. Gladun, L. S. Lozinskiy et al., "Obrabotka informatsionnykh massivov v avtomatizirovannykh sistemakh upravleniya" [Processing Data Files in Automated Management Systems], Kiev, Izdatelstvo "Naukova dumka", 1970, 217 pages):

> group access, reduction of data set, selection, access of extreme records, analysis of data set, reconfiguration and computation version.

The prototype programs are worked out for each determined operation on data sets and for frequently used program designs. The complexity of the program module is determined mainly by the set of route-paths, according to which control is transferred upon fulfillment of the module. The routes and processing fragments, typical for each specific type of module, are determined by using decision tables. (Footnote) (E. Jodan [Yourdan], "Strukturnoye proyektirovaniye i konstruirovaniye programm" [Structural Design and Program Design], translated

Условия (1)	(2) Допустимые комбинации								
	1	2	3	4	5	6	7	8	9
Конец файла *A* (3)	0	0	0	0	0	0	1	1	1
Конец файла *B* (4)	0	0	0	1	1	1	0	1	1
Значение ключа файла: (5)									
A меньше, чем файла B (6)	0	0	1	0	0	1	0	0	0
A больше, чем файла B (7)	0	1	0	0	1	0	1	0	1
Значения ключей файлов *A* и *B* равны (8)	[illegible]	0	0	1	0	0	0	1	0
Действия (9)									
Обработка ситуации: (10)									
«есть запись файла *A* и нет записи файла *B*» (11)			×			×			
«есть запись файла *B* и нет записи файла *A*» (12)		V			V		V		V
«есть записи обоих файлов» (13)	×			×					
Чтение записи файла *A* (14)	×		×	×		×			
Формирование таблицы записей файла *B* (15)		×					×		
Признак равенства ключей (16)	1	0	0	1		0	0		
Завершение работы (17)								×	

Figure 1. Converted Decision Table of SOMDAV Prototype Program

Key:

1. Conditions
2. Permissible combinations
3. End of file A
4. End of file B
5. Value of file key
6. A less than file B
7. A greater than file B
8. Values of keys of files A and BV are equal
9. Values of keys of files A and B are equal
9. Actions
10. Processing situation
11. Record of file A and no record of file B
12. Record of file B and no record of file A
13. Records of both files
14. Read record of file A
15. Formulation of table of records of file B
16. Feature of equality of keys
17. Completion of work

from English, edited by L. N. Korolev, Moscow, Izdatelstvo "Mir", 1979, 416 pages) A converted decision table for joint processing of two data sets--A and B, in each of which there are records with identical values of comparision keys, is presented in Figure 1. The records of data set B with identical keys are entered in the main memory table, while records of data set A are read and processed with the table. Processing the ends of files reduces to an ordinary working diagram, the maximum possible value is assigned to the comparison keys. Five conditions at the input are analyzed to formulate the complete decision table and there is a total (possible) of $2^5 = 32$ combinations. But only five of them are acceptable and the remainder are rejected due to contradiction. The operation of the prototype program can be represented by a graph with nine vertices (according to the number of possible states), while the graph itself is described by an adjacency matrix measuring 9 x 9 in Figure 2. (Footnote) (V. V. Lipayev, "Kachestvo programmnogo obespecheniya" [Software Quality], Moscow, Izdatelstvo "Finansy i statistika", 1983, 263 pages) The one is located in position $\dot{I}$, $\dot{J}$ in this matrix, if one can convert from vertex $\dot{I}$ to vertex $\dot{J}$ within one step. Otherwise, a zero is placed in the position of the matrix. Based on analysis of the decision table and of the adjacency matrix, a

design of a prototype program for joint processing of files with duplicating keys A and B (SOMDAV) is worked out, in which 26 various transitions from one state to another is implemented, with a total number of operators of initial text of the prototype program in PL/1 language is equal to 101. The designs of the remaining prototype programs were worked out in similar fashion.

Результирующее состояние (1)

(2) Исходное состояние	1	2	3	4	5	6	7	8	9
1	1	1	0	0	0	0	1	0	0
2	1	1	1	1	1	1	0	0	0
3	1	1	1	0	0	0	1	0	0
4	0	0	0	1	1	0	0	0	1
5	0	0	0	0	0	1	0	0	0
6	0	0	0	1	1	1	0	1	1
7	0	0	0	0	0	0	1	0	1
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	1	0

Figure 2. Adjacency Matrix of States

Key:
1. Resulting state
2. Initial state

The following were worked out to automate the programming operations: prototype program generator, text editor and program complex for issue of normalized jobs on basis of prototype program and for computation of quantative indicators of the working efficiency of programmers.

The experience of using prototype programs in modification of ASU software demonstrated their high efficiency: the labor productivity of programmers increased and the deadlines for completion of programming work were reduced by a factor of 4-5 compared to typical time norms. (Footnote) ("Tipovyye normy vremeni na programmirovaniye zadach dlya EVM" [Typical Time Standards for Computer Programming Tasks], Moscow, Gosudarstvenny, komitet SSSR po trudu i sotsialnym voprosam, 1981, 28 pages) Modification of the software was simplified considerably, while design of the programs reduces the volume of program documentation by factor of 2-3. A total of four exercises of two hours each is sufficient to assimilate the prototype program in the activity of medium-skilled programmers.

6521
CSO: 1863/34

AUTOMATED SYSTEM OF INTEGRATED DATA PROCESSING FOR THE 'ISKRA-226'

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by N. Gorelik, candidate of technical sciences, V. Grinshteyn, and A. Finogenov: "To Each By Strength"; under the rubric: "The Computer and Us"; first paragraph in italics in source; second paragraph in boldface]

[Text] The SoyuzmorNIIproekt [State Planning, Design, and Scientific-Research Institute of Marine Transportation, Soviet Ministry of the Maritime Fleet] specialists, developers of the "Morflot" ASU [Automated Control System] consider that in creating a program, it is necessary to take the user's level of preparation into account.

Almost every day the mail brings news resembling military operations summaries from the site of events. The process of computerization is proceeding in the country on a wide front. Understandably, this raises no small number of questions and issues: How to more quickly master programming basics; is it possible to make interaction with a computer even more accessible and the study of computers more vivid? These are only some of the questions raised by "NTR" readers. Thus, the reader shares experience, proposes solutions...

The problem of the "computer user" is not a new one. Paradoxical as it may be, frequently some person does not want to become a "user." One reason for such behavior is fear or an aversion to relearning or mastering a complex contemporary technology.

In order to satisfy the person who has independently gone to a computer for help, it is necessary to know his peculiarities. We have theoretically divided a whole spectrum of users into three types. The first is purely a consumer. His attitude toward a computer is similar to his attitude to everyday technology. He would like to perform simple manipulations, similar to turning a television on or changing the channel, and obtain the required information. The second type of user can be compared with a design engineer. To obtain the results he needs he is prepared to create the corresponding program made up of prepared building blocks, as is done in a child's nursery. Finally, the third user type is a programmer who needs a selection of procedure options which correspond to his qualification level to create the necessary program modifications quickly.

A program can be oriented toward any defined consumer type. But it is better if the program satisfies the requirements of all types and can present all the new alternatives as the growth of qualification and requirements allows. This latter alternative can be demonstrated with the example of an automated system of integrated data processing (ASIOD) developed by the authors for the domestic personal computer "Iskra-226."

Within the limits of the system the "pure consumer" can obtain required information as a result of interactive access in a form that is customary and usual for each person. If requirements increase in number of interaction with the computer, then the person makes the transition to the "design engineer" category of software. It should be noted, however, that such a division is very arbitrary.

A user of this type can construct a form for himself in which he would like to obtain information, for example, a table, or a report, or a document with confirming signature, and so on. For this, it is sufficient to "draw" this form on the screen, using characters present on the terminal keyboard. In just this way he can create a convenient form for data entry into his data base or construct a new data base generally "from scratch." To do this he must, in an interactive session with the computer, respond to questions and carry out all steps of such a construction: giving the list of variables about which he needs information, describing these variables, defining their type (date, numerical information, name, and so on) and dimension, and drawing the input and output information forms. After filling the data base with information he can perform searches and correct mistakes using special programs.

The "design engineers" are a more widespread category of specialists. They must be proprietors of information and their own computer. Therefore they must solve questions of a general character: the processing technology, the path of information retrieval and the provision for its reliability and update. The system makes these alternatives available.

A special automatic mode in ASIOD provides for creating new data bases in place of obsolete ones and allows information to be "pumped across" from the old data base into the new one.

Finally, the programmer, classified by us as the third type of user, can independently write his own program and include it in the system package.

By this means the system can, at any time, turn that facet to the user which he needs at a given moment. It does not require any preliminary preparation from him. He can begin to do more complex work himself of his own accord.

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UDC 669.162.221.2;66.012

MICROPROCESSOR FOR CONTROLLING MOVEMENT OF OXYGEN TUYERE

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 19-20

[Article by Candidate of Technical Sciences A. N. Neretin and Candidate of Technical Sciences V. I. Sherstnev]

[Text] The problem of managing the steel process using scientific methods of control is of special significance in converter steel production, in which the time expended for smelting is reduced, the consumption of materials and energy resources is reduced and the periods of production equipment between repair is increased.

To solve this problem, a microprocessor MPU for controlling the movement of a tuyere was developed at the Lipetsk Branch of the Special Design Office, Scientific Production Association Chermetavtomatika and was introduced at the Novolipetsk Metallurgical Combine imeni Yu. V. Andropov. The microprocessor was based on the LIUS-2 hardware complex (KTS).

A block diagram of controlling the motion of the tuyere is presented in Figure 1.

A point located 150 cm below the electromechanical stop EMU, is adopted as the reference point TO with respect to which the production elevations are fixed. The tuyere F of converter K is fixed in the extreme upper position KVP by the terminal switch KVV and in the extreme lower position KNP by the lower terminal switch KVN. The stroke of the tuyere is 1,811 cm, ΔH is correction of the position of the tuyere, its size is in the range of 100-150 cm and is taken into account when formulating the controls for moving the tuyere. Oxygen is delivered through cutoff valve K31 and is delivered to the tuyere by cutoff valve K32.

According to the production process for smelting steel, the tuyere is moved in the following manner. One of the extreme top position switches is lowered at a rate of 0.2 m/s to the initial position (IP) and is then moved at a rate of 0.734 m/s to the blasting zone. When the tuyere reaches production elevation OTS1, the shutoff valve K32 is switched on (oxygen is delivered to the tuyere) and the rate of its movement is reduced to 0.2 m/s. Upon further movement of the tuyere, the rate is switched from 0.2 to 0.05 m/s at production elevation

OPS2 and it is lowered at this rate into the molten steel bath. As the blasting time assigned by the steel smelting technology passes, the tuyere is raised at a rate of 0.2 m/s. When the tuyer reaches production elevation OPS3, the rate of its motion is switched from 0.2 to 0.5 m/s and shutoff valve K32 is closed. The oxygen remaining in the tuyere and in the connection hose continues to the converter. The tuyere moves upward to elevation IP at a rate of 0.734 m/s from production elevation OPS4.

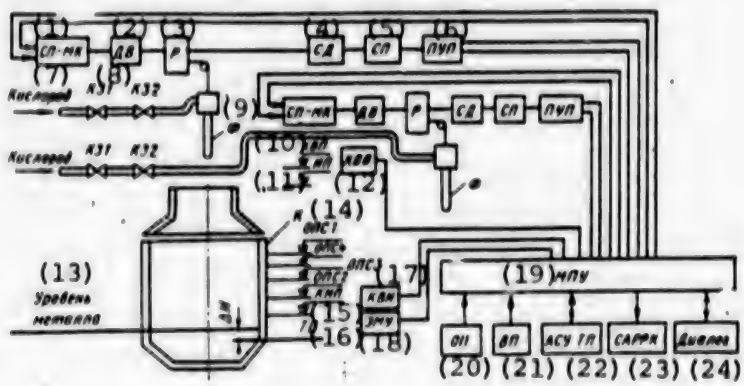

Figure 1. Block Diagram for Controlling Movement of Oxygen Tuyere

Key:

1. Drive system with converter mechanisms
2. Motor
3. Reduction gear
4. Selsyn-sensor
5. Selsyn-receiver
6. Angular displacement converter
7. Oxygen
8. Valve
9. Tuyere
10. Extreme upper position
11. Initial position
12. Terminal switch
13. Metal level
14 Production elevation
15. Extreme lower position
16. TO reference point
17. Lower terminal switch
18. Electromechanical stop
19. Microprocessor
20. Main console
21. Auxiliary console
22. Automated production process management system
23. Automated oxygen flow rate regulation system
24. Interaction

Commands to control the movement of the tuyere are transmitted from the microprocessor to the drive system with SP-MK converter mechanisms and are processed by motor DV, which moves the tuyere through reduction gear R. A selsyn-sensor SD and a selsyn-receiver SP, the shaft of which is rigidly connected to the angular displacement converter PUP, are used to determine the position of the tuyere.

The main console OP is designed to enter and display the tuyere control data, to exchange data with the upper-level automatic control system, to assign correction and current position of the tuyere and also to assign the operating modes of the microprocessor.

The auxiliary console VP is used to enter the production elevations, the numbers of the program for moving the tuyere, the number of the degree of oxygen flow rate, for assigning the oxygen flow rate, the time of oxygen blasting of the steel, for the position of the tuyere and for display of input data.

The microprocessor exchanges information with the automatic oxygen flow-rate regulation system SARRK, the automated steel-smelting production process management system--ASU TP steel-smelting--and the Dialogue system within the automated production process management system, which implements the interaction functions with the technician-operator.

Development of the microprocessor resulted in the need to solve the following combination of problems: to investigate more extensively the steel-smelting process to establish the effect of the parameters of moving the tuyere (rate of motion and position of the tuyere) on the quality of smelting, to work out on the basis of the indicated investigations an adequate mathematical model of the blasing process and to work out on the basis of the mathematical model effective and reliable algorithms and programs for controlling the movement of the tuyere, which permit one to take into account in the best manner the production situations that occur.

The microprocessor provides control in the "Manual," "Automatic" and "Control computer" modes. The position of the tuyere is monitored and displayed in the "Manual" mode. Using the "Automatic" mode, the technician-operator dials the number of the program for moving the tuyere and gives the command to process any of eight programs written in th microprocessor memory. Each of the programs includes up to ten steps of oxygen flow rate. The time of converting to the next step or the amount of oxygen, upon depletion of which one must go to the next step, is indicated in the program. The automatic oxygen consumption regulation sys'em process the given step of oxygen consumption. In the "Control computer" mode, the microprocessor works out the settings for the position of the tuyere, coming from the automated steel-smelting production process management system.

When operating in the "Automatic" and "Control computer" modes, the technician-operator is able to correct the position of the tuyere by transmitting a command from the main console. The tuyere moves in this case at a speed of 0.05 m/s upward or downward until the technician-operator changes his instruction. The position of the tuyere is displayed in these modes.

The microprocessor performs the following functions: "monitoring the position of the tuyere," which measures the position of the tuyere with respect to the reference point with absolute error of ±2.5 cm. The system generates a correction all when the tuyere reaches the extreme upper position and extreme lower position elevations and transmits diagnostic messages of a malfunction of the measuring channel, "display of tuyere's position" displays on a digital board the current position of the tuyere and the frequency of operation is second, "selection of program for moving tuyere during blasting" permits the technician-operator to select one of eight possible programs, "correction of program for moving tuyere during blasting" operates on technical-operator's instructions, "moving tuyere with required speeds" switches the speed of the

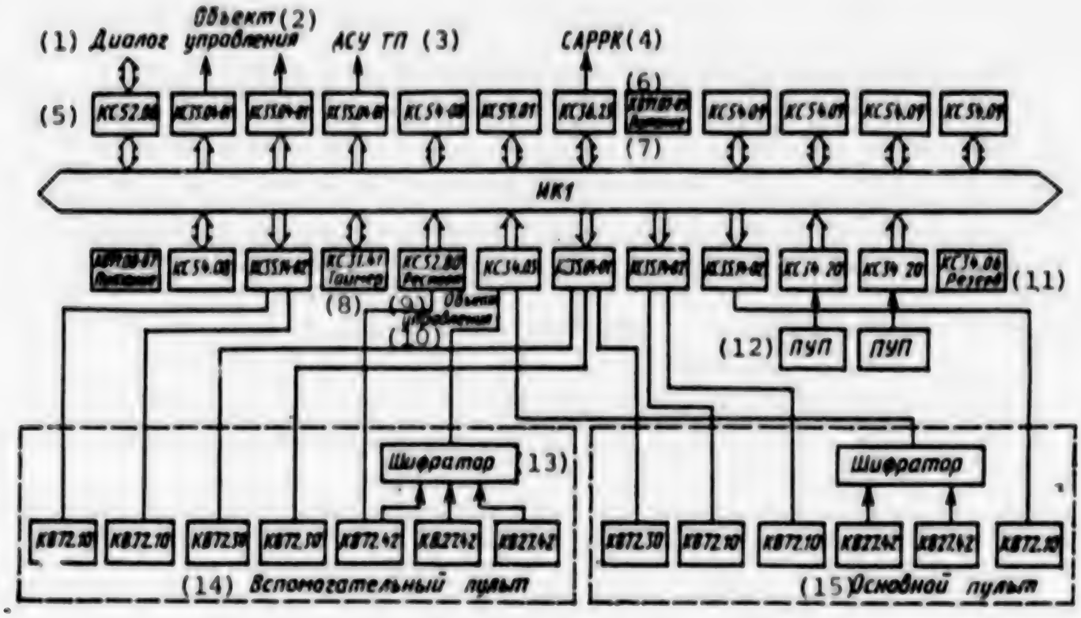

Figure 2. Block Diagram of Hardware of Microprocessor for Controlling Movement of Oxygen Tuyere Based on LIUS-2 Hardware: KS 52.06--linear bit-parallel controller; KS 35.04-01--digital signal output modules; KS 54.08--energy-dependent main memory element; KS 59.01--control element; KS 36.23--alphanumeric display integration modules; KV 91.07-05--interface power supply; KS 54.09--main memory element; KV 91.08.07--noninterface power supply; KS 35.14-02--digital display control module; KS 31.41--timer; KS 52.80--bus access controller; KS 34.03--initiative digital signal input module; KS 34.20--pulse signal input module; KS 34.06--digital signal input module; KV 72.10--digital display module; KV 72.30--signal module; KV 27.42--digital signal control modules; IK1--asynchronous parallel interface; Dialogue--system which implements interaction functions with technician-operator; ASU TP--automated steel-smelting production process management system; SARRK--automatic oxygen consumption regulation system; PUP--angular displacement converter

Key:

1. Dialogue
2. Control facility
3. Automated production process management system
4. Automatic oxygen consumption regulation system
5. KS
6. KV
7. Power supply
8. timer
9. Restart
10. Control facility
11. Standby
12. Angular displacement converter
13. Encoder
14. Auxiliary console
15. Main console

tuyere according to the given program. The tuyere is moved in the "Manual" mode with display of its position, it is moved in the "automatic mode according to the assigned program and the position of the tuyere varies in the "Control computer" mode according to the settings transmitted from the automated steel-smelting production process management system. "Display by control station" signals of oxygen consumption upon conversion to next step and also of the position of the tuyere at this step, "assigning correction of tuyere's position" is worked out from instructions from the main console, "data exchange" transmits data to the automated steel-smelting production process management system about the current position of the tuyere, transmits information about correction of the tuyere's position, about the number of the tuyere, about the operating mode of the microprocessor, about failure of the microprocessor, about reception of the given position of the tuyere, about transmission of authorization to the automatic oxygen consumption regulation system to open (close) shutoff valve K32 and about reception of the signal to raise the tuyere upon completion of blasting.

A block diagram of the microprocessor hardware based on the LIUS-2 hardware is presented in Figure 2. The configuration of the complex provides multiprogram control of the movement of the tuyere, two-way joint data exchange with the automatic oxygen consumption regulation system, the automated steel- smelting process management system and the "Dialogue" system and operation in the continuous 24-hour mode. The selected configuration eliminates data loss if the power supply deviates and provides interchangability of hardware of the same type without any changes or regulations.

The efficiency of the microprocessor can be determined as part of the total efficiency achieved due to use of automated steel-smelting production process management system. The technical and economic indicators of converter production due to introduction of the automated steel-smelting production process management system is improved due to reduction of the additional tipping of the converter and of preblasing, due to increasing the stability of the converter lining, due to reduction of ferroalloy consumption, oxygen consumption and energy resource consumption and due to a decrease of wear of the production equipment. The microprocessor executes two of 25 functions within the automated steel-smelting production process management system: programmed movement of the tuyere during blasting and working out the settings for the position of the tuyere. The approximate annual saving is 150 thousand rubles.

6521
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STRUCTURAL-SYSTEMS ANALYSIS AS A BASIS FOR INCREASING EFFECTIVENESS OF SCIENTIFIC AND TECHNICAL INFORMATION NETWORKS

Baku NARODNOYE KHOZYAYSTVO AZERBAYDZHANA in Russian No 8, Aug 86 pp 39-44

[Article by D.M. Mekhtiyev, T.A. Ibragimov, R.K. Arakelov, Azerb Scientific Research Institute of Scientific and Technical Information]

[Abstract] It has become obvious that without significant technological improvement, the State Automated Scientific and Technical Information System GASNTI) cannot significantly improve its productivity or decrease costs. New, more progressive technologies are required, based on specialization and cooperation of scientific and technical information organizations and maximum utilization of joint resources. This has been achieved by introducing the network principle of functioning of the State Scientific and Technical Information Network. Specialists of the authors' institute have undertaken a computerized analysis of the structure of information requests of the State Scientific and Technical Information System in Azerbayjan, Armenia and Georgia. It was determined that many of the requests for information in each republic were on subjects better handled by the information services of the other republics. Combining the three republic scientific and technical information systems into one, with each handling requests for information in the subject area most familiar to it, could theoretically speed and improve the quality of information responses, while saving tens of thousands of rubles. The first experiments on practical implementation of this process have been begun.

6508/13046
CSO: 1863/133

UDC 62-525

AUTOMATIC MEMORIES - THEIR CHARACTERISTICS AND APPLICATION IN AUTOMATED PRODUCTION PROCESS MANAGEMENT SYSTEMS

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 22-24

[Article by Candidate of Technical Sciences Yu. N. Potepalov and Engineer T. A. Neumoyna]

[Text] The basic directions for using memories are as follows: storage of different mode parameters (their programs) in multibrand product output with subsequent transmission of data to control cells, storage of process parameters in the control cells (regulators, programmers and so on) and storage of variable values of the production process (sensor signals) for subsequent automation of economic analysis of production work.

Besides these main functions, memories also execute other auxiliary functions, for example, storage of signals upon sequential transmission of them through a common bus.

The basis indicators of memories are data capacity (for example, in decimal bits) and also the write, storage and playback time. The overall dimensions of the design are also significant.

The following production processes are examined to determine the approximate values of the indicators required for efficient operation of the control systems: production of reinforced concrete products, dyeing spools of yarn and fabrication of "SEARCH" pneumatic integrated circuits.

Partial variation of the programs is typical for all of them, namely: changing the brand of concrete--once per minute, changing the shapes of the reinforced concrete products--once per hour, preparation of dye--once per day and punching one layer of the SEARCH integrated circuits--once per hour.

The short length of the cycle is related either to high performance of the equipment (concrete mixer, programmed stamping) or to its large numbers (30 dyeing units, 10-20 vibrating platforms for the reinforced concrete product molds). These processes are also characterized by tens or hundreds (in the case of dyeing) of operating programs and each program contains up to 10 parameters, which must be controlled with accuracy up to 1 percent. Thus, the total memory capacity is estimated in the range of 100-10,000 decimal bits.

Beside programming tasks, economic indicators (percent fulfillment of the plan, consumption of materials and energy, number of fabricated products) must be calculated in the automated control system. To do this, the readings of the sensors or the calculated current values of indicators should be stored periodically.

The indicators should correspond to the nomenclature of the production subdivisions (for example, three teams at the reinforced concrete products plant and the shop as a whole). Moreover, the accounting periods for the work of the collectives (shift, days, month) should be accounted for. The word length of such indicators as materials consumption and volume of manufactured concrete reaches 6-8 decimal bits. The corresponding calculations make it possible to estimate the memory capacity of economic indicators up to 100 decimal bits.

The requirements on the memories under consideration are determined by designation of the stored data.

The centralized program memory is characterized by the write time (unessential), storage time (without limit, including that when the power is switched off), playback time (within several seconds, bearing in mind the frequency of access to the memory--once per minute) and requirements on overall dimensions (unessential).

The memory in local control cells should meet the following requirements: write time--less than one second, storage time--from several minutes (in cyclic production) to several days (in continuous production), playback time--less than one second; requirements on overall dimensions are more rigid with regard to the larger number of cells.

Economic indicators should be stored with the following parameters: write time--less than one second, storage time--without limit and with the power switched off and playback time--less than ten seconds; the requirements on overall dimensions are unessential with regard to the relatively small memory capacity.

It is obvious from comparison of the physical technical parameters of different memory cells (see table) that there is no best design for all the indicators at once.

Therefore, the memories for automated production process management systems are selected as a function of selection of the parameter (or parameters), the value of which must correspond to the requirements on it.

The memories are divided by designation into three groups, for each of which the most effective type of memory, characterized by the main parameter, is selected.

The memory storage time is selected as the main parameter for centralized program storage.

(1) Ячейки памяти	(2) Код	(3) Габариты, см³	(4) Габариты на 1 бит информации	(5) Энергопотребление: (6) емкостное, Дж	(7) мощностное, Вт	(8) Время: (9) памяти, мин	(10) воспроизведения, с	(11) записи, с	(12) Уровни сигналов управления, МПа: (13) входа	(14) выхода	(14) Минимальное давление питания, МПа
Триггер: (16) на УСЭППА (17)	(18) Двоичный	41	41	4.58	—	(19) Пока существует питание	(20) Не существенно*	0.2	0; 083	0.14	0.08
на НЭМП (21)	То же (18)	18	18	4.66	4	(19) То же	(20) То же	0.2	0.03	0.14	0.035
на ПОИСК (22)	»	17	17	—	4	»	»	0.2	0.07	0.112	0.06
Емкостная память (23) на УСЭППА	» (24) Десятичный	105	105 30	—	—	932 68.9	»	0.2	0,063	0.14	(31) Любое
Емкостная память на (25) НЭМП	Двоичный Десятичный	38	38 9	—	4.9	971.3 68.9	»	0.2	0,016	0.11	(31) То же
Пневмотумблер УСЭППА (26)	Двоичный	35	35	(27) Очень мало	(28) Непрерывного расхода нет	(29) Неограниченно	»	0.1—1	(30) Не пневматический	—	»
Цифровые задатчики (переключатели) (32)	Десятичный	23	7	То же (27)	То же (28)	То же (29)	»	2—5	—	—	»
Память на носителях (перфолента) (33)	Двоичный	115***	8×10-****	»	8	»	**	(34) Осуществлена вне АСУ	—	0.01	(35) Зависит от усилителя
Память на носителях (магнитная лента) (36)	Двоичный	470	470	»	2	»	**	То же	—	0,001	То же
Задатчик (37) УСЭППА	Десятичный Аналоговый	22	6.5 3.2	»	1.5	»	(20) Не существенно	10—20	—	0,02—0.1	0.126 0.126
Емкостная память на (25) НЭМП	Аналоговый (38)	36	51	4.66	0.5	12.2	То же	0.2	0.02—0.1	0.02—0.1	0.126
Счетчик механический (39)	Десятичный	098	20	(27) Очень мало	5	12.2	»	0.2	0 и 1	0.2	0.126

Note. If memory cells are assembled into memory modules, the playback time is less than 2-3 s.

*Significantly less than the transmission time to the unit--data user.
**Determined by search time for location of unit on which necessary data are written.
***Overall dimensions of unit with storage device.
****Overall dimensions of storage device.

(Key on following page)

Key:

1. Memory cells
2. Code
3. Overall dimensions, cm^3
4. Overall dimensions per bit of data
5. Power consumption
6. Capacity, J
7. Power, W
8. Time
9. Memory, min
10. Playback, s
11. Write, s
12. Control signal levels, MPa
13. Input
14. Output
15. Minimum power supply pressure, MPa
16. Flip-flop
17. On USEPPA [not further identified]
18. Binary
19. While there is power
20. Unessential
21. On NEMP [not further identified]
22. To SEARCH
23. Memory capacity on USEPPA
24. Decimal
25. Memory capacity on NEMP
26. Pneumatic toggle switch of USEPPA
27. Very little
28. No continuous consumption
29. Unlimited
30. Non-pneumatic
31. Any
32. Digital controllers (switches)
33. Memory on storage units (papertape)
34. Written outside automated control system
35. Dependent on amplifier
36. Memory on storage devices (magnetic tape)
37. USEPPA controller
38. Analog
39. Mechanical counter

The pneumatic toggle switch, memory on the storage units and controllers have unlimited storage time according to the table. Let us consider their application in an automated production process management system. For example, the ten brands of concrete for five of its components (cement, sand, stone, water and chemical additive) in the NORMALIZATION complex are stored by adjustable controllers. The brand of concrete assigned by the operator is called up on the console on the two-input AND module and on the controlled analog contact (AK) module. The outputs of the analog contact modules are connected through the components in the bus. Thus, fifty sensors with analog output signals are installed in the complex. The advantages of the adopted solution include the fact that the analog signal required for operation of the control cell is stored.

The use of memories on storage units (magnetic tape or papertape) is typical for large sequential-reading memory capacities. The disadvantage of these program storage units is the impossibility of online readjustment of them or of changing the stored program and the difficulty of finding the place on the tape where the required data are written. Moreover, the disadvantages of the readers are the complexity of the design and the relatively large air consumption.

But these disadvantages are sometimes not as significant, for example, for storage of the program for punching the layers of the SEARCH integrated circuits. The layers are punched sequentially and up to 50 dies, the program of which is located on seven lines of an eight-track papertape, operate during each step. One SEARCH circuit layer is processed within 100 steps, while the integrated circuit contains up to 15 layers. Thus, the integrated circuit

processing program is located on 28 m of papertape. However, the strictly controlled sequence of processing the layers and of reading the papertape determ... the efficiency of using the punched storage unit.

Unli... sequential readout of programs, the capability of online readjustment of prog...ams must be provided. Thus, for example, when preparing the dyes (dyeing the spools of yarn), the data for the brands of dye must arbitarily be called for production reasons and it must also be corrected periodically. Dispite the large memory capacities, the memory has an original design and small overall dimensions.

It is better to use the main memory, designed on the flip-flop circuits or on the circuits of the capacitive connections with valve in the control cells, since fast write and playback time is typical for these circuits.

Since storage in the capacitive circuit is achieved by cutting off the air in a closed space, the temperature and power supply pressure fluctuations and leakage of air from the chamber limit the storage time.

It is obvious from the given table that the data in the logic units with capacitive memory on the NEMP [not futher identified] can be stored for 15 hours in binary code and 1 hour in decimal code. The power supply can be switched off briefly in this case, which increases the effectiveness of using the memories in automated production process management systems compared to memories on flip-flop circuits.

An example of practical application of capacitive memory is the memory of controlling the proportions of components for the BTUL complex. Up to four BTUL complexes are connected to one NORMALIZATION unit. Five analog values for the time of one measurement, i.e., less than 3 minutes, are stored in the memory capacitors.

According to the requirements on the capacity of the economic indicators, one can conclude that it should be implemented remotely by a controlled non-volatile memory. Counter cells are in best agreement with the given parameters among all the memories.

The counter is a subunit, containing a mechanical-pneumatic pusher and ratchet mechanism with disk punch card attached to an axle. The readout signals are switched upon the call signal. The counter converts from one state to another when a pulse signal is delivered to the mechanical-pneumatic pusher, which rotates the perforated storage device to the next (one of ten) position. Besides the position code, a pulse signal for controlling the mechanical-pneumatic pusher in the counter of the next bit is read during one rotation of the disk.

Counters are used in the UChPLAZIV and UChPROZIV pneumatic equipment complexes, where the concrete production, expenditure of materials and fulfillment of the plan per shift and per month are taken into account. The total number of counters in the UChPROZIV is 48 submodules and that in the UChPLAZIV is 12 submodules.

Operation of the pneumatic memories for two years showed the reliability and simplicity of maintenance by low-skilled personnel.

Analysis of the given materials indicates the possibility of implementing memories for 100 decimial bits within a single section of the NEMP (450 x 660 x 1,000 mm). However, a memory for 10,000 decimal bits, which cannot be achieved in modern memory cells, are required to automate such production as, for example, dyeing the yarn. Therefore, new equipment with smaller dimensions must be developed. The available models of memories that reduce the linear dimensions by a factor of 5-10 show promise of working in this direction to solve the problem of integrated automation of small, but numerous plants with severe operating conditions.

The given analysis shows that known memory cells can execute all the main functions of production data storage within the hardware of the automated production process management system; the cell indicators (by overall dimensions) for one bit of stored data are low and it can be recommended that the range of their application be expanded from the results of development and operation of pneumatic memories.

6521
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IMPROVEMENT OF QUALITY OF SYSTEMS FOR PROCESSING ECONOMIC INFORMATION

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 pp 43-44

[Article under the rubric "Technology Abroad" by Candidate of Economic Sciences S. Stoyanova, People's Republic of Bulgaria]

[Text] At the 12th Congress of the Bulgarian Communist Party, Comrade T. Zhivkov emphasized that in the development of the materials and equipment base for socialism principal attention must be paid not to a quantitative growth in it but primarily to qualitative improvement of production engineering equipment in operation at the present time, by taking into account the ensurance of high labor productivity in the production of high-quality products.

In this connection, the designers of information systems must strive toward the further perfection and improvement of the control system. At today's stage of social development, factors which exert an influence on the quality of control systems and, more precisely, on the quality of systems for processing economic information, are particularly important; these are:

The rapid development of new generations of computers (microprocessors) and, thus, improvement of the quality of information processing systems.

The presence of a skilled work force in sufficient numbers which can work with this equipment. The need for it is due also to widening of the demand for electronic data processing.

One essential element for improving the quality of processing systems is the efficiency of processing. Among methods of reducing the input of programmers' labor, a special place is occupied by the development of programs oriented toward a specific application which can be used, with certain modifications, by various users with provision of the possibility of adapting them to their own needs without the help of the writers of the programs.

One of the most important of today's application program packages (PPP's), developed by the Interprogramma Institute, for data processing, is the SM-SATELLIT ASU [automated control system], or interactive program system for the efficient management of production and storehouses. It includes four sets

of programs: a general-system, production, cost-indicator and storehouse. The functions and tasks of these sets have been described most fully and in very great detail.

The problems discussed in connection with the use of this package can be divided into two types: functional relationship and software-hardware. The functional relationship consists in the division and coordination of functional management tasks between the management levels of an enterprise. The software-hardware relationship consists in the interrelationship of certain kinds of hardware for the purpose of solving the problems posed, by using the appropriate programs (directly distributed processing, which will be discussed below, is in mind).

This package has the advantage that it utilizes dynamic data, i.e., the information is up to date, operating, and discloses the nature of the production process itself (the "Production" set with its specific features), as well as its results, i.e., cost indicators (the "Cost Indicator" set).

The "Storehouse" set is regarded as an auxiliary one which provides the production process with the necessary raw and semifinished materials; however, special attention is paid to it in association with the necessity of economizing on raw and semifinished materials.

Let us dwell in greater detail on the "Cost Indicator" set, by relating its problems directly to the requirements of the economic machinery. How are these problems being solved by computer data processing facilities at several enterprises of the NRB [People's Republic of Bulgaria]?

The Integrated System for Control of Product Quality (KSUKP), introduced at the Combine imeni D. Ganev, makes possible a relationship between the quality of work and wages, the improvement of contracts, and the introduction of the achievements of science, technical progress and advanced know-how, and also makes possible involvement of the public in control of quality and the qualifications of personnel. Improvement of the data processing system, including the calculation of economic indicators in accordance with the "Statute on the Economic Machinery" of the NRB Council of Ministers, is of considerable importance.

The "Cost Indicator" system contains the following: the standardized plan assignment for a brigade of workers; calculation of brigade standard wages; a cost estimate of unfinished production; brigade cost accounting indicators--the standard wages of a brigade; reporting on production and contracts; reporting on actual prices for produced products and materials; defective merchandise by department and brigade; estimate of the defective merchandise of a brigade; and estimate of defective merchandise per operation.

The assignments for a brigade are expressed in the form of a standardized plan assignment, and production schedules and the specific requirements for products to be produced are ratified by its means. The "Statute on the Economic Machinery" calls for the adjustment, in annual plan assignments, of the quality, kinds and range of products when this is occasioned by conditions

of production and sales (the mastery of new products and the introduction of new technologies, changes in consumer demand, etc.).

Operating data processing is performed at two levels--the upper (plant) and lower (department), depending on the tasks and functions which the ASU is to perform. Information associated with the normative reference base of an enterprise is stored at the upper level and serves the purpose of solving problems oriented toward a longer term of execution (e.g., technical-economic planning, etc.). The processing of operations planning information takes place at the lower level (e.g., the preparation of an operation-by-operation schedule). [illegible]r, there are no precise criteria for dividing information between t[illegible] levels; each enterprise does it in its own way.

The software-hardware relationship of the PPP described has several specific problems: they include the data transfer and processing modes; introduction of the interactive mode of inputing, processing and displaying information, as well as the direct pick-up and processing of information at its point of origin; and the development of a data base at two levels: central and local.

Of the information processing modes which are used most often in practice, it is necessary to name the batch mode and the real-time and distributed data processing modes. Let us dwell on the latter mode, since it is conducive to improvement of the quality of the solution of management problems. The formation of a computer network is assumed here, on one hand, and, on the other, the presence of the appropriate software. The necessity of this kind of information processing is due to the specific features of the controlled system.

The software is also implemented at two levels: Minicomputers of the SM-4 type are used at the lower level, and a model of the YeS [Unified Series] series of computers at the higher level. Interaction between them is carried out by means of type SM-1604 or SM-7206 video terminals. The operation-by-operation schedule is prepared on a minicomputer, which brings it to the maximum close to the user of operating information. After the information is processed, it is transferred to the upper level if necessary.

For the purpose of solving the functional problems presented at an industrial enterprise it is important to form a data base which is also oriented toward two levels: central and local. Their presence is responsible for employment of the above-indicated distributed processing mode. The information required for operations management (in association with its tasks) is placed in the local data base.

In distributed data processing, certain difficulties arise relating to the compatibility of various kinds of equipment when it is used, but they are compensated by shortening of the time for data processing.

Here, three kinds of communication are implemented: terminal, interface and program; personal microcomputers can be used for carrying out certain auxiliary jobs.

Interface communication assumes this kind of communication between terminals and computers in the development of a computer network; the program form of communication represents part of the new capacity of data processing systems.

Program communication assumes the existence of the appropriate programs for the two management levels indicated. The ASUP/DOS [Plant Management Automation System/DOS] and ALFA packages, or the PPP's of the IASUP (Interactive ASUP) system, as well as the SETOR-SM, SETOR-SM ZAPROS [QUERY], SETOR-SM RAZVITIYE [DEVELOPMENT], etc., SUBD's [data base management systems], have become widely used in developments by the Interprogramma Institute. Distributed processing has created new relationships between systems programmers and applications programmers.

In conclusion, we would like to stress the following. First, these systems should be helpful at all levels of planning; i.e., they should provide the possibility of accomplishing both the general and specific in the solution of particular operations planning problems. Secondly, the systems are being developed on the basis of two kinds of data bases (central and local), which makes it possible to compare, analyze and the like. Thirdly, the data processing mode is reliable, efficient and user-oriented. The information entry method is the terminal method, which makes it possible easily to make contact with the system, as well as to correct and find information.

8831
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AUTOMATION OF ACCOUNTING FOR, FORECASTING OF RESERVES OF PHYSICAL RESOURCES

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 p 42

[Article by candidates of economic sciences V.V. Stoshkus and V.M. Rutkauskas]

[Text] One important problem presented by the economic experiment is the problem of unutilized and above-norm reserves of physical resources, the level of which to a considerable degree exerts an influence on the final operating figures of enterprises, since increased interest charges are collected from them. Therefore, the problem of the efficient management of production reserves at the regional level, including enterprises and supplying-and-selling organizations, has become particularly topical.

The formation of unutilized and above-norm production reserves of physical resources at an enterprise is caused by imprecise determination of the demand for them. As studies have demonstrated, a number of enterprises overstate the demand for certain kinds of basic types of materials. Above-norm reserves are formed also because of the improper choice of the form of supplying.

On the other hand, unutilized and above-norm production reserves are often formed on account of slip-ups during the stages of planning the supplying of materials and equipment and the order portfolio. For example, the order portfolio is formed at the majority of enterprises only a month before the start of the year being planned, but lists for the delivery of ferrous and nonferrous metals are presented 125 days before, and for remaining products 45 days before. This situation is conducive to the formation of unutilized and above-norm reserves for some kinds of physical resources and a shortage of others.

An automated accounting, monitoring and forecasting system should straighten out the situation by eliminating above-norm physical reserves. The "Accounting and Monitoring" and "Analysis and Forecasting" subsystems are the most important in it.

The practicability of the development of a subsystem for accounting for and monitoring production and commodity reserves in a region owes itself to the necessity of forming a data base for the subsequent formation of

a reasonable quantity and structure for combined reserves, as well as for making decisions on regulating their level in the process of efficient management. As demonstrated by the experience of creating the accounting system in the Lithuanian SSR Gossnab [State Committee on Supplying of Materials and Equipment], it is appropriate to single out the following tasks in it:

Calculation of norms for commodity reserves at depots.
Accounting for and monitoring of level of reserves at depots.
Accounting for flow of physical resources at a depot.
Operations monitoring of the flow of the most important kinds of physical resources at depots.
Calculation of anticipated reserves at depots.
Accounting for the presence of uninstalled and superfluous equipment and materials at enterprises.
Accounting for and monitoring the state of production reserves at enterprises.
Accounting for and monitoring the state of combined (production and commodity) reserves in a region.

Simultaneously with the solving of these problems, in the process of automated calculation of the demand for physical resources a determination is made of both the basic demand (stated by enterprises during the time of the development of the plan for the supplying of materials and equipment) and the additional demand (stated by enterprises during a plan period).

Thus, the formation of a data base for the demand and reserves makes it possible to implement in the "Analysis and Forecasting" subsystem a model of stochastic forecasting of the level of reserve supplies in a region as a function of the additional demand and above-norm production reserves of physical resources. In this model the total expenditures associated with the formation of a reserve supply are defined as the sum of the cost of storage of the excess reserve stock and possible losses from a shortage of each kind of physical resource.

For the purpose of determining the size of the reserve supply it is necessary to determine, on the basis of actual data for past years, the probability density of the additional demand. As an analysis of actual data on the additional demand has demonstrated, most often it obeys the law of a log-normal distribution, i.e., a need arises for additional small quantities of physical resources, and less frequently for large quantities.

In calculating the size of the reserve supply it is necessary to take into account the fact that part of the enterprises of a region do not fulfill their production plan and they also order unnecessary materials because of slip-ups during the stage of planning the supplying of materials and equipment and the order portfolio. Therefore, plans for deliveries of physical resources to them must be corrected, since otherwise above-norm production reserves can originate. The products freed in the process are earmarked for replenishment of the reserve supply. The situation in this case is similar to that which occurs with the origin of an additional demand; i.e., the distribution curve is a log-normal one.

And so, in automation of the calculation of the level of reserve supplies of physical resources in a region for a plan period it is necessary to carry out the following principal steps (cf. table):

Table

Step	Subject of calculations	Calculation times and frequency
I	Determination of basic demand of region's enterprises for physical resources	Once or twice a year--in preparation of the plan for supplying of materials and equipment
II	Determination of additional demand of region's enterprises for physical resources and formation of data base	Monthly--during the plan period
III	Determination of unutilized and above-norm production reserves at region's enterprises and formation of data base	Quarterly--during plan period
IV	Calculation of parameters of log-normal distribution from data on additional demand and above-norm production reserves	Once a year--prior to start of a new plan period
V	Calculation of level of reserve supplies of physical resources in a region*	Ditto

*For basic calculation equations cf. the following article: Stoshkus, V.V. "Model of Sensible Level of Production Reserves" in "Primeneniye matematicheskikh metodov, vychislitelnoy tekhniki i orgtekhniki v materialno-tekhnicheskom snabzhenii" [Application of Mathematical Methods, Computer Technology and Managerial Aids in Supplying of Materials and Equipment], Moscow, TsNIITEIMS Gossnaba SSSR, No 10, 1982, pp 4-5.

Practical calculations performed for a number of kinds of non-ferrous and ferrous metal rolled products demonstrated that the optimal ratio of the reserve supply and annual demand in the Lithuanian SSR varies from 1.5 to 9.7 percent. These calculations formed the basis of practical measures for the management of reserves of non-ferrous and ferrous metals in the Lithuanian SSR.

8831
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MICROCOMPUTER CONTROL SYSTEM FOR 'UNIVERSAL-15M' ROBOT

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 8, Aug 86 pp 23-25

[Article by candidates of technical sciences A.A. Alekseyev and F.F. Kotchenko and engineers O.Yu. Belash, M.O. Ilin and Ye.I. Rukosuyev]

[Text] One direction of the Leningrad "Intensification-90" program is the modernization and automation of existing production processes by employing modern computer technology facilities. Because of the universality of microcomputers, they are being extensively introduced into production systems, in particular, in control systems for industrial robots (PR's). The use of microcomputers makes it possible to construct universal control systems with the possibility of readjusting for a specific type of PR, and to improve the reliability of control systems, as well as to increase productivity on account of shortening of the time for training a PR and editing control programs, to expand the production-process capabilities of existing PR's, to form complicated mechanical trajectories for the PR's working member, to receive, process and output signals to external production-process equipment, and to maintain communication with a higher-level control system.

At enterprises there are a great number of PR's of various types with obsolete individual control systems and having poor reliability, a limited number of positioning points, the impossibility of the formation of complex mechanical trajectories for the robot's working member, and poor error-probability performance and, as a consequence, the possibility of the occurrence of accident situations. For example, the experience of using the "Universal-15M" PR under in-plant conditions has demonstrated a number of shortcomings.

Therefore, the "Universal-15M" industrial robot control system was developed, based on an SM 1800 microcomputer (fig 1). The use of a microcomputer made it possible to eliminate from operation 80 percent of the equipment of the APS-1 [automatic signal transmitter] rack, which improved the operating reliability of the entire control system as a whole. The microcomputer is connected to the industrial robot through its own standard controlled-system interfaces (USO's) and an interfacing unit (BS) which was developed. Six voltages, U_z , which determine the amount of displacement of the PR's working member for six degress of mobility, enter the R-C network of the BS unit from the analog signal output module (MVAS). Voltages U_z are amplified in level

by scalers U1 to U6 and are established in the inputs of the APS-1 rack. The differences of voltages U_z and the voltages, U_p, of position pickups DP1 to DP6 are amplified as error signals, U_r, by amplifiers UN1 to UN6 and enter the EPT-6 thyristor drive rack. Signals U_g from tachometer generators TG1 to TG6 are subtracted from signals U_r and the difference voltages, power-amplified and transformed with respect to shape by power amplifiers UM1 to UM6, are supplied to actuating motors ID1 to ID6 of the drives for the robot's degrees of mobility. At the moment when the robot's working member arrives at the predetermined point in space, amplifiers UN1 to UN6 generate service signals for all six degrees of mobility. These signals are united by means of an AND gate into signal U_1, which enters the microcomputer via the discrete signal input module (MVVDS). With this signal the microcomputer proceeds to the subsequent operations for controlling the industrial robot. The robot's working member is controlled through the discrete signal output module (MVDS). The modernized control system, by means of six discriminators, D1 to D6, and the OR gate of the BS unit, also makes possible automatic self-switching-off of the robot with impermissible deviations of the working member from the specified mechanical trajectory. By uncomplicated switching, the "Universal-15M" PR can be controlled completely from its own control system.

The basis of the system's software is a program for processing any set of points in space for any number of degrees of mobility provided in the industrial robot. The positioning points in space are determined by the industrial robot's mechanical trajectory. A flowchart of the trajectory processing algorithm is given in fig 2.

The voltage matrix is in the form of voltage codes for the individual degrees of mobility for all programmable points of the trajectory in space. Initial data are input from a console.

The algorithm makes it possible to specify serial, I, or parallel, II, trajectory completion modes. In the serial mode control with reference to a point in space is performed serially for each controlled degree of mobility. Thus, the robot's mechanical trajectory toward the point in space is of a stepwise type. In the parallel mode control with reference to a point in space is performed simultaneously for all controlled degrees of mobility. The parallel mode has higher speed than the serial. But the serial mode is preferable, for example, in adjusting the trajectory and with the complexity of access to a specific point in space. The trajectory completion mode is assigned from the console. The MVVDS is polled first in the serial mode. With the arrival of a completion signal, voltage, U_z, is output to the next controlled degree of mobility, and the process is repeated until all degrees of mobility have been run through. In the parallel mode voltages U_z are first output for all degrees of mobility and then the completion of displacements for all degrees of mobility is awaited by polling the MVVDS. When all degrees of mobility have been run through, the state of the working member is checked.

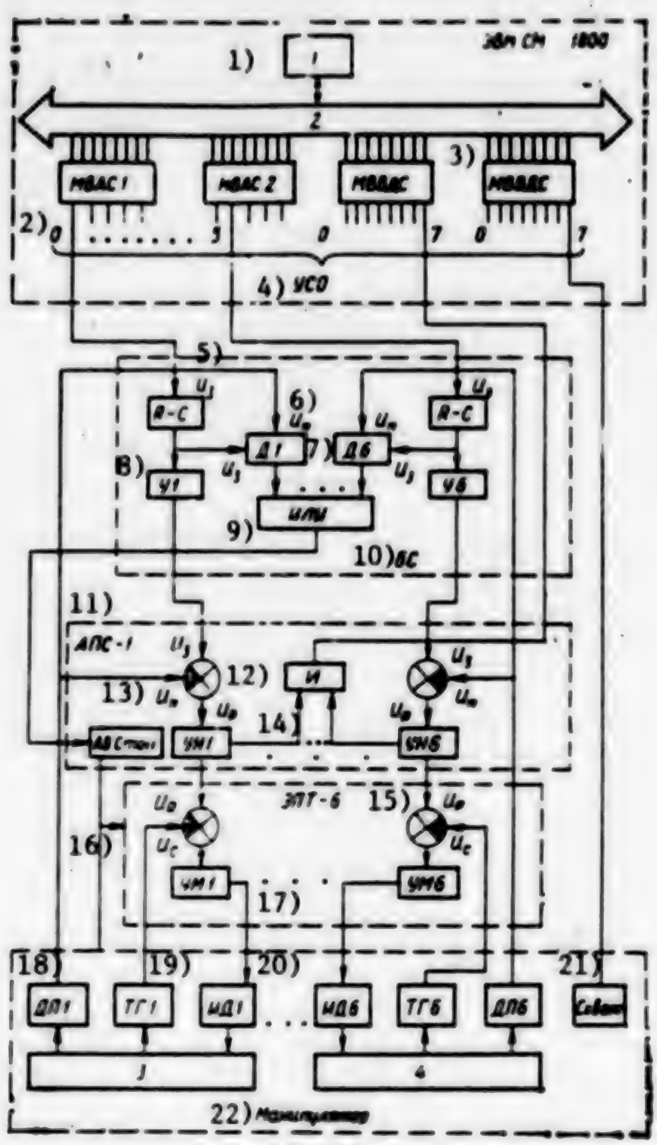

Figure 1. Functional Diagram of Control System: 1—processor; 2—interface; 3—degree of mobility No 1; 4—degree of mobility No 6

Key:

1. SM 1800 computer
2. MVAS1 [analog signal output module]
3. MVVDS [discrete signal input module]
4. USO [controlled-system interface]

[Continued on following page]

5. U_z
6. U_p
7. D1 [discriminator No 1]
8. U1 [scaler No 1]
9. OR gate
10. BS [interfacing unit]
11. APS-1 [automatic signal transmitter]

12. AND gate
13. Automatic stop
14. $U_{\text{Б}}$
15. EPT-6 [thyristor drive]
16. U_{8}
17. UM1 [power amplifier No 1]
18. DP1 [position pickup No 1]
19. TG1 [tachometer generator No 1]
20. ID1 [actuating motor No 1]
21. Gripping device
22. Manipulator

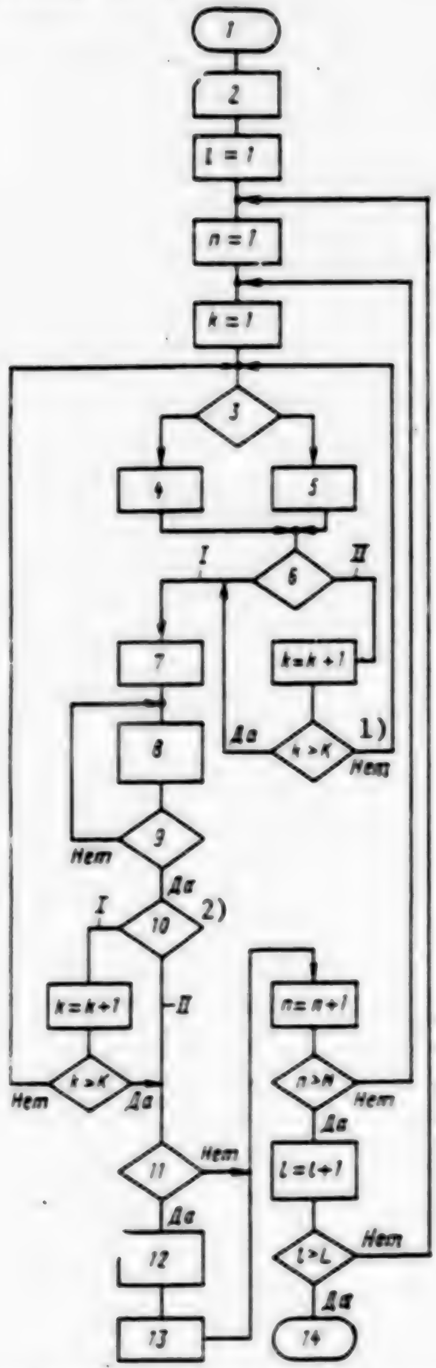

Figure 2. Trajectory Processing Algorithm Flowchart:
[Continued on following page]

1--Start; 2--L , N , K , mode, voltage matrix; 3--number of MVAS; 4--output of U_z to MVAS1; 5--output to MVAS2; 6, 10--mode; 7, 13--delay; 8--poll MVVDS; 9--Movement Completed?; 11--change of state of robot's working member; 12--output of state of robot's working member to MVDS; 14--End; K--number of controlled degrees of mobility; k--degree of mobility order number; N--number of points of trajectory in space; n--order number of point of trajectory in space; L--number of trajectory completion cycles; ℓ--order number of trajectory completion cycle

Key:

1. No
2. Yes

If it is necessary to change this state, the corresponding value of the state of the working member is output to the MVDS. After the point in space has been completed, a check is made of the number of completed points. The numbers of completed cycles are checked at the end of completion of the trajectory. The "Delay" units are used because of the system's sluggishness (as compared with the speed of computer machine instructions). One "Delay" unit makes it possible to poll the MVVDS not immediately after the output of voltage. Otherwise the correctness of the signal is not guaranteed. The delay equals 10^{-3} s. The other "Delay" unit makes it possible to fix the position of the working member when its state is changed. The delay equals ∿0.7 to 0.8 s.

The ASSEMBLER language was used in programming. The system's software occupies less than 1K bits of the computer's memory. In the process of operation the microcomputer can be used in parallel for serving another kind of equipment or for performing various control and computing functions.

Thus, the modernized control system for the "Universal-15M" industrial robot makes the following possible: to connect any computer with a standard controlled-system interface (microcomputer, minicomputer, etc.); to specify complex trajectories in space; high reliability of the entire control system; the elimination of accident situations on account of the addition of a self-switching-off unit in the BS [interfacing unit]; the ability to communicate with a higher-level control system; and the possibility of flexible reaction to a change in situations in the framework of a flexible production system under conditions of small-scale production.

8831
CSO: 1863/36

AUTOMATED MILKING MACHINE

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Unattributed article: "Computer-Milker"]

[Text] The computer-milker is endowed with the experience of its "human prototype" and the knowledge of a veterinarian and a zoological engineer.

The specialized electronic system, created by scientists at the Leningrad Veterinary Institute in cooperation with instrument makers, is successfully passing tests at a dairy of the "Gatchinskiy" sovkhoz (Leningrad Oblast).

A computer on the farm proved to be a competent aid in all aspects of milk production technology. Operating subtleties which, in some instances, do not always turn out well even for an experienced operator, are within the power of the electronic milkmaid. Milking according to the given program is conducted without detriment to the health of the livestock. As soon as milk extraction is completed, the milk containers are switched off. The system indicates this with light and audio signals.

In the photo: (left to right) S. Krasnov, senior scientific associate of the dairy cattle breeding automation laboratory of the Leningrad Veterinary Institute, A. Suprunovich, sovkhoz automated complex engineer and S. Grigoriev, engineer of the milking management automated center of the complex. Photo I. Kurtova (TASS) [Photograph not reproduced.]

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IMPROVEMENT OF SET OF STATE STANDARDS, GUIDELINE DOCUMENTS FOR COMPUTER-AIDED DESIGN SYSTEMS

Moscow STANDARTY I KACHESTVO in Russian No 9, Sep 86 pp 13-15

[Article under the rubric "Standards: Technical Progress, Economy, Efficiency; Automation of Documentation Development" by Ye.S. Krankov and S.A. Terpeneva, VNIINMASH [All-Union Scientific Research Institute of Standardization in Machine Building]]

[Text] The requirements of scientific and technical progress dictate the necessity of developing in a short space of time highly efficient equipment with quality indicators not inferior to those of the best models in the world. In this regard, the most important stage of the life cycle of products is the design stage, on which principal quality indicators rest and on the efficiency of the work of which the time it takes to develop products depends to a great degree.

The traditional methods of manual designing do not make it possible to solve the problem of speeding the development of and putting into production new generations of high-efficiency equipment, and only the use of computer hardware and mathematical methods in the designing of products under conditions of a computer-aided design system (SAPR) will make it possible to solve the problems presented by the requirements of scientific and technical progress.

The decree of the CPSU Central Committee and USSR Council of Ministers titled "On Measures for Speeding Scientific and Technical Progress in the National Economy" calls for the extensive development of automation, including in the field of design-engineering work. The USSR Gosplan, GKNT [State Committee on Science and Technology] and the USSR Academy of Sciences, with the participation of interested ministries, have developed an all-Union program in the area of computer-aided design systems.

The technical standards provisions for this program were entrusted to Gosstandart [State Committee on Standards]. Gosstandart developed a set of measures for the purpose of implementing this assignment. The principal ones of these are the following:

1. The development of a set of State standards and guideline and procedural documents for standard methods of performing and documenting work. This measure included a review of existing standards and the development of procedural instructions and recommendations on the performance of predesign research and on the documenting of SAPR components and method software systems (PMK's).

2. The development of SAPR invariant components and method software systems. This most important measure was aimed at development of the general-system core of an SAPR. Its makeup should include the following: an SAPR interactive monitor implementing automated planning and control of the design process, including providing the designer access to these processes; a data base management system (SUBD) providing for the information requirements of design procedures and the information compatibility of various PMK's; and a geometrical processor implementing the geometrical modeling of items being designed, etc.

3. The development of State standards and technical requirements for method software systems for SAPR's.

4. The development of guideline and procedural documents on the interaction of SAPR's with flexible production systems and ASU's [automated control systems] in machine building.

With the development of these documents a unified automated chain will be regulated, including both the designing and engineering of a product, its production-process design, and the production of programs for equipment with numerical control, making it possible to make the designed product under conditions of flexible production systems.

5. The development of standard methods, solutions and method software systems for the computer-aided design of products. This includes the development of the following: standard functional diagrams for the designing of products; methods for the geometrical modeling of two- and three-dimensional entities; communicative formats for describing printed circuit boards; basic PMK's for the computer-aided design of parts and assembly units, for forming the structure and products at the level of physical effects and structural components, etc.

6. The development of standard methods, solutions and method software systems for computer-aided production-process design. This set of NTD [technical standards documentation] can be characterized as documentation regulating computer-aided design under conditions of the functioning of flexible production systems, since it includes documents for the development of production-process design methods and PMK's for the following functions: assurance of streamlinability, the designing of production processes, the preparation of programs for equipment with numerical control, and the designing of production-process equipment.

7. The development of a set of guideline and procedural documents relating to the procedure for an examination by experts and the standardization of SAPR

method software systems. The classification of PMK's as products for production engineering purposes necessitates the establishment of a unified procedure for developing them, testing, examination by experts, standardization, funding and application.

The above-listed measures supplement the existing set of State standards and guideline documents on SAPR's, defining terms, stages of development, the structure and content of work by stages, the structure, content and symbolism of documents on SAPR, and organization of the creation and development and evaluation of the quality indicators for the creation of SAPR's. The structure of SAPR's is regulated by eight State standards, four guideline documents and some procedural recommendations which establish a unified concept for the structure of an SAPR: makeup, classification, specifications for kinds of facilities, and standard components.

The existing set of State standards for SAPR's has been analyzed at the present time for the purpose of developing suggestions for improving it, in fulfillment of Decree No 65, of 14 January 1986, of the USSR Council of Ministers, titled "On Improvement of the Procedure for Developing and Coordinating Technical Documentation in the Development and Putting Into Production of New (Modernized) Machine Building Products."

The number of existing standards has been reduced in accordance with the suggestions made.

Nine State standards (GOST [All-Union State Standard] 23501.2-79, GOST 23501.3-79, GOST 23501.5-80, GOST 23501.7-80, GOST 23501.11-81, GOST 23501.12-81, GOST 23501.14-81, GOST 23501.15-81 and GOST 23501.118-83) have been abolished from 7 May 86 to 1 Jun 86 by the decree of Gosstandart. For the purpose of eliminating from documents requirements of a procedureal nature and organization questions relating to the development of SAPR's, including the procedure for coordinating and approving documents, it has been planned to develop--in place of the above-indicated State standards (excluding GOST 23501.12-81) and GOST 23501.1[illegible]-85 and RD [guideline document] 50-245-81--two guideline documents: "SAPR's. Structure, Content and Documentation of Work in Process of Development of Systems" and "SAPR's. Documentation of Components by Kinds of Facility."

Before these documents are published, the abolished standards can be used as the recommended.

The plan is to develop also in 1987 the State Standard titled "SAPR's. Principal Regulations" to replace the State standards setting the requirements for individual kinds of facilities and for organizing the development of SAPR's (GOST 23501.0-79, GOST 23501.4-80, GOST 23501.9-81, GOST 23501.12-82. GOST 23501.13-81, GOST 23501.16-81 and GOST 23501.17-82).

The state of the implementation of these measures is illustrated in the diagram.

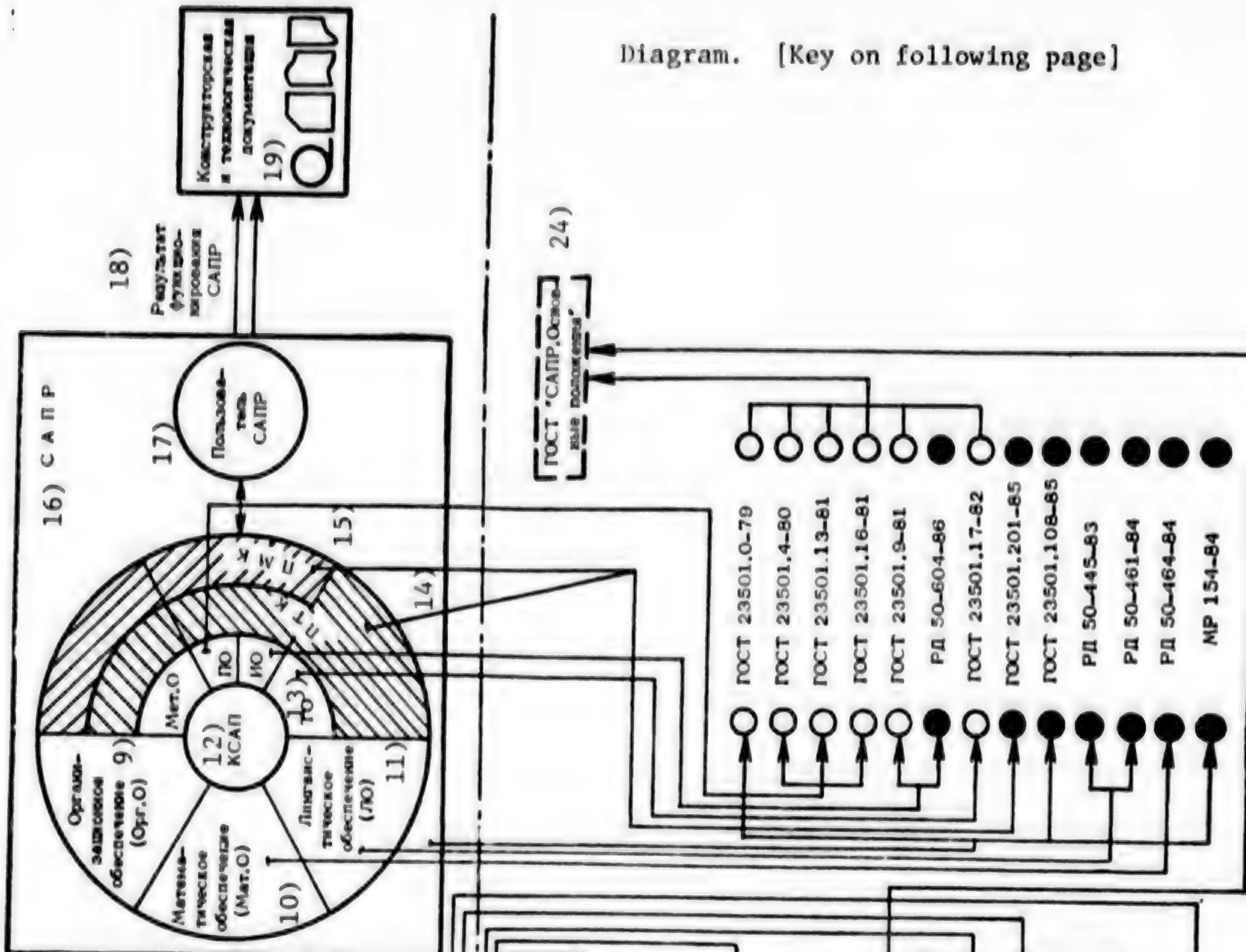

Diagram. [Key on following page]

Key:

1. Items to be standardized
2. Stages of development
3. Terms
4. Standard methods and solutions for performance of work
5. Standard methods and solutions for documentation
6. Types and sets of documents
7. Makeup and content of work
8. Process of development of SAPR
9. Organization facilities
10. Software
11. Linguistic facilities
12. KSAP [set of computer-aided design facilities]
13. TO [hardware], IO [data base organization and management], PO [software], Met. O [procedural facilities]
14. PTK [software-hardware system]
15. PMK [method software system]
16. SAPR
17. SAPR user
18. Result of functioning of SAPR
19. Design and production-process documentation
20. GOST's, RD's and MR's [procedural recommendations]
21. GOST 24.601-86, "Automated Systems. Development Stages"
22. RD "SAPR's. Structure, Content and Documentation of Work in Process of Development of System"
23. RD "SAPR's. Documentation of Components by Kinds of Facility"
24. GOST "SAPR's. Principal Regulations"

Symbols:

● ● Norm-setting document on SAPR's in effect at present.

⊠ ⊠ Abolished document.

◑ ◑ Document suggested for development in place of abolished one.

○ ○ Existing document proposed to be abolished.

▭ Document developed in place of abolished one.

⬚ Document being developed at present time to replace abolished one or to replace suggested one.

The arrows leading from the circles point to the documents developed or to be developed to replace the State standards or RD's indicated.

After the completion of work on the improvement of the set of standards, the set of NTD's regulating the structure of SAPR's in the process of developing them will include seven State standards and eight guideline documents, namely: GOST 22487-77, GOST 24.601-86, GOST 23501.10-81, GOST 23501.108-85, GOST 23501.119-85 and GOST 23501.201-85, the State standard titled "SAPR's. Principal Regulations", the RD titled "SAPR's. Structure, Content and Documentation of Work in Process of Development of Systems", the RD titled "SAPR's. Documentation of Components by Kinds of Facility", and RD 50-250-81, RD 50-459-84, RD 50-445-83, RD 50-461-84, RD 50-464-84 and RD 50-604-86.

Five documents have also been developed at the level of procedural recommendations: MR 116-84, MR 194-85, MR 187-85, MR 123-84 and MR 154-84.

The performance of all the work planned will make it possible to improve the quality of NTD's by taking into account the experience of many years of the use of standards in organizations of branches of industry in the development of SAPR's, and to eliminate unnecessary regulation of the creative activity of SAPR developers by lowering the category of norm-setting documents (changing individual State standards into RD's) and eliminating requirements of an organization and procedural nature from them.

The further development of standardization in the field of SAPR's in the 12th Five-Year Plan period, as was said above, will be directed toward the development and standardization of standard method software systems (PMK's), representing a product for production engineering purposes. These PMK's can be used as components of SAPR's in the development of them, which will make it possible to improve considerably the efficiency of work on standardization and to solve the problem of the development of SAPR's in small and medium-size planning and design organizations.

All this will be conducive to reducing by approximately 25 to 30 percent the labor intensiveness of the development of SAPR's in organizations of branches of industry and to improvement of the quality of systems created.

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INTERACTIVE COMPUTER-AIDED DESIGN SYSTEM

Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 9, Sep 86 pp 36-39

[Article by Candidate of Technical Sciences I. F. Ushakov]

[Text] The need to increase significantly labor productivity in engineering preparation for production predetermined the timeliness of the problem that concerns the development and introduction of computer-aided design and manufacturing systems (SAPR TP) in industry. This work has been conducted most intensively by a number of organizations and enterprises of Minstankoprom [USSR Ministry of Machine Tool- and Tool-Building Industry] during the past decade. It is during this period that CAD/CAM, developed by **State Design-Manufacturing Institute of Woodworking Machine-Tool Building (Pskov) and Orglitmash [not further identified]** (Rostov-na-donu) and the Ryazan and Minsk Branches of the NPO [Scientific Production Association] Orgstankinprom, began to function in the plants of the sector. Relatively weak functional capabilities (the design of production processes of machining some classification varities of parts using universal equipment is usually possible) and understatement of the role of the operator-technician, who performs only functions of preliminary manual coding of input data for subsequent machine design of technology, are typical for these systems.

Sequential fulfillment of functions by the technician and computer in combination with nonautomated routine labor of the technician makes it possible to relate the corresponding CAD/CAM systems to first- and second-generation systems. (Footnote 1) (I. F. Ushakov, "Sistemy avtomatizirovannogo tekhnologicheskogo proyektirovaniya v melkoseriynom i seriynom mashinostroyenii" [Computer-Aided Design/Manufacturing Systems in Small-Serial and Serial Machine Building], Moscow, VNIITEMR, 1985, 36 pages)

The general view toward the problem of computer-aided design/manufacturing is now changing. The national economy needs products as a whole rather than individual classification varieties of parts, toward which the first- and second-generation systems are oriented.

The experience of the State Design-Manufacturing Institute of Woodworking Machine-Tool Building (GPTIdrevstankoprom) in development of third-generation CAD/CAM systems at the subsector level is illuminated in the article.

The distinguishing feature of the developed CAD/CAM system is its orientation toward working up the required set of production documentation for each newly assimilated product. The basic requirements on the system with this postulation of the problem is complex nature, universality, integratability relative simpliticy, possibility of development and improvement and maximum economy.

The complex nature of this system is provided by the fact that technician-computer interaction according to previously developed scenario is adopted as its determining functional mode. Each such scenario regulates the logical sequence of heuristic decision-making in production design in the interactive mode, i.e., it is its own type of interactive design algorithm. The scenario for any interactive problem is formulated according to a single method, which creates prerequisites for connecting the required set of tasks to the system.

The universality of the system is the consequence of the interactive nature of inmplementing the most important tasks. The possibility of going beyond the bounds of the software or basic database management and organization of the specific features of a specific enterprise (unlike the second-generation system) is achieved in this very case.

These features are regarded as online information, entered into the computer during direct interaction between the technician and computer. Accordingly, the system is invariant with respect to the specifics of the enterprises operating it and does not require any principle adjustment of any kind for conditions of a specific user.

The integratability of the third-generation system is considered by function (horizontal) and by levels (vertical) of production design. The scenarios of all interactive tasks are constituent parts of a single systems scenario with free access to each of them during operation of the CAD/CAM system. It is sufficient upon request of the computer to communicate the feature of the corresponding scenario (horizontal integration) to the display operator for conversion to any interactive task; one reaches the required level of production design (for example, according to the itinerary-operation-control program of a machine tool with ChPU [numerical program control]) automatically according to the feature formulated in the dialogue (vertical integration).

The relative simplicity of the system is confirmed primarily by the fact that technician-computer interaction is maintained in natural user language, i.e., the operator is not required to know any artificial formal languages. Moreover, the initial startup of the system also does not require a specific database, oriented toward a specific user. The period of assimilating the system depends only on the time that the operator-technicians study the scenario of interactive tasks and on their acquiring the corresponding skills of working at the display unit to be used.

The capability of developing and improving the system is supported by the following: the information and program complexes of the CAD/CAM system have block-modular organization that permits constant connection of new scenarios and tasks (functional development of the system). The content of the dialogues to be used has a tendency toward constant simplification as experience is

accumulated in operating the CAD/CAM system and of developing on this basis interactive macrodefinitions (qualitative improvement of the system).

Maximum economy of the system is achieved due to the insignificant required resource of the computer (100 kilobytes of main memory and 1 problem-oriented disk drive) and also by the capability of multiterminal functioning of the interactive part of the CAD/CAM system.

The set of functional subsystems and tasks of a the CAD/CAM system reflects the adopted orientation of the system toward working out the set of production documentation for each newly assimilated product.

A brief description of the subsystems and tasks that comprise the first stage of the CAD/CAM system and that are in different stages of development is given below.

The product information preparation subsystem encompasses the functions related to classification of data on magnetic carriers about manufacturing preparation of objects (parts and assemblies included in the product).

Task 1.01 "Service processing of systems data sets" has specific designation and for this reason is not considered in more detail.

Task 1.02 "Formulation of general data about production preparation objects" is intended for initial (and one-time organization and formatting on magnetic disk of those data about the production preparation objects, which are essentially used in each subsequent task of the system (name and designation of the part, its overall dimensions and weight, name and brand of material and so on). Moreover, the design-production code and the summary cipher of the macro-profile of the material are formulated for each part. The task is implemented in an interactive mode.

Task 1.03 "Check and correction of common data about production preparation objects" logically supplements and completes tasks 1.02. It permits one to call to the display screen general data about any production preparation object (according to the direct-access principle), which permits one to check visually the data formulated earlier and if need be to correct them and again write to the magnetic disk in the new edition.

The classification analysis subsystem encompasses the preparatory functions, related to classification and analysis of the most important classification structures of the product to be newly developed, which is the main prerequisite for qualitative implementation of the production design tasks.

Task 2.01 "Classification anaylsis of parts of the product" classifies the production preparation objects contained in the product (parts and assemblies) according to the design-production codes, and the following are determined by using it: a general list of those codes in the product, the number of names, units and lists of parts having the same code and the weight characteristic of a group of parts, combined by a single design-production code.

Task 2.02 "Classification analysis of macroprofiles of materials" is a complete analogue of task 2.01, but its algorithms use summary figures of the macroprofiles of materials. Tasks 2.01 and 2.02 do not require interaction, i.e., they are implemented in the automatic mode.

The production process design subsystem, being the central system, supports automated development of all the necessary set of production documentation and normalization of production processes as a whole for the product with regard to all the types of production existing at the corresponding enterprise.

Task 3.01 "Design of manufacturing processes according to blank-stamping production" has the obvious designation.

Task 3.02 "Design of manufacturing processes for machining parts" is characterized by some features from the viewpoint of traditional views toward the corresponding function of production preparation: there is not artificial autonomy of the individual components of this function, related to determination of the classification varieties of parts (bodies of rotation, flat parts, housings and so on) or to machining parts on different types of equipment (universal machine tools, automatic machines, machine tools with numerical programming control and so on). In other words, the task integrates working out documentation for production processes, performed on metalworking equipment.

Task 3.03 "Design of production processes for assembly of units and parts" has the obvious purpose.

Task 3.04 "Design of production processes for acceptance check of parts" has the goal of strict regulation of both the metrological equipping of production and of the process itself of measuring the specifications of production preparation objects and of determining their conformity to the drawings and specifications.

Task 3.05 "Design of production processes of welding assemblies" has the obvious purpose.

All tasks of the subsystem under consideration are implemented in the interactive mode.

The normative calculations subsystem encompasses the functions that directly follow from the production design tasks and are related to calculation and classification of labor, material and other norms for the product to be newly developed.

Task 4.01 "Calculation of detail-specified norms of consumption of rolled pipe" realizes the obvious and obligatory function of production preparation of the new product.

Task 4.02 "Calculation of normal laboriousness for a product" is based on the resulting information of the tasks of the production process design subsystem and provides classification of the calculated laboriousness for types of work, groups of equipment, occupations, ranks of jobs and so on.

Task 1.03 "Calcultion of normal consumption of cutting tools" is a logical continuation of task 3.02 and has the obvious designation.

Among the ennumerated thirty functional tasks, eight (1.02, 1.03, 3.01, ..., 3.05, 4.01) are implemented by interaction, whereas the remaining five (1.01, 2.01, 2.02, 4.02 and 4.03) are executed in the automatic mode.

Each individual scenario of interactive tasks is expressed from the formal-information viewpoint by the combination of two, logically related modules, the first of which reflects the problem-content aspect of the interaction and the second reflects the management of interaction.

The problem-supporting module (conditional identifier T) includes interactive directives and requests, information messages to be used in interaction, references of possible production decisions, alternative situtions of management of the interaction and working fields of arrangement of online interactive information. In other words, all the information which is output or can be output to the alphanumeric display screen during implementation of the interactive task of the CAD/CAM system is classified in module T.

The interaction maintenance module (conditional identifier V) classifies the elementary procedures of maintaining a dialogue in a specific task of the CAD/CAM system. Each such procedure is an independent interactive information processing function. The list of these functions is comparitatively short (approximately twenty names). The description of their content and formal representation in module V is a subject of special consideration and goes beyond the framework of this article.

The combination of scenarios of interactive tasks is the so-called knowledge base of the system (unlike the traditional database), which is the most essential and most valuable part of the third-generation CAD/CAM system.

The computer hardware to be used for the third-generation CAD/CAM system includes the YeS-1022 computer and the YeS-7906 or YeS-7920 video terminal station. The programs of the system have four main sections: the service programs of the database, the interction support programs, the math programs and the production documentation formulation programs. The service programs (section 1) are related to task 1.01, have special designation and are not considered here.

The interaction support programs (section 2) are invariant with respect to specific scenarios of the functional tasks of the CAD/CAM system. They include the pilot program (manager) and set of subroutines; each of them corresponds to a specific interaction procedure. The load program module of the interactive part of the system is thus a single module and is used to implement any scenario.

The math programs (section 3) encompass the original functions of the tasks, related to arithmetic conversion of the information formated in interaction and implemented in automatic mode. Examples of these functions are computation of the detailed norm of materials consumption, computation of the time norm for conversion or operation and so on.

The print programs (section 4) support output forms of production documentation of the established model on the computer.

The program texts are written in PL/1 algorithmic language and the individual systems programs are written in Assembler language. The operating system is OS, version 4.1 and higher.

Any production preparation object in the system is identified by two features, including the letter of the inclusion product and the conditional number of the part (assembly). Both the letter (any character of the Latin alphabet) and the number (the number that reflects the physical ordinal arrangement of the drawing, part or assembly in the set of design documentation) are online information, written on disk together with general data about the production preparation object (task 1.02) and further serve as the direct-access key to the corresponding information in any task of the system.

Thus, the CAD/CAM system can be adjusted to a specific production preparation object in direct interaction, which permits online conversion to computer-aided design of any part or assembly of any product.

The interactive software is designed for multiterminal functioning of the system, i.e., toward simultaneous and parallel use of all the displays of the operating video terminals. Each display is organizationally independent of the other displays when solving interactive tasks of the systems.

Production design tasks are solved according to a unified scheme: an interactive set of input data, the computation part and formulation of the resulting documentation.

The result of interaction is formulation on magnetic disk of the formalized production process of machining the part (assembly). Automatic processing of the formalized production process for technical normalization of operations and transitions is achieved in the computation part. The concluding part is related to printing out the production process according to established format.

Each of these parts is implemented offline, which permits one to review the intermediate production design data through the display screen and permits possible correction of it.

There is no coding tablet-type document in the system, which is traditional in first- and second-generation CAD/CAM systems. General data about the production preparation objects, as already noted, are formulated in task 1.02. With regard to more detailed characteristics of production preparation objects (for example, data about surfaces), they are entered in the computer in the interactive part of the corresponding task of the system.

Thus, one can make the following conclusions. Development and introduction of the third-generation CAD/CAM system arms machine builder-technicians with qualitatively new, modern methods of production design when setting up new machine tools, machines and equipment for production.

Extensive use of man-computer interaction opens up the capability of direct connection of the technician's intelligence and the enormous speed of the computer, sharply reduces the amount of routine and low-productive labor and predetermines to the same extent the development of the specialist's creative capabilities.

In the final analysis, all this is the basis for a significant increase of the effectiveness of engineering preparation of production in machine building.

The described system is in experimental operation at GPTIdrevstankoprom and is being assimilated by a number of enterprises and organizations of different sectors of the national economy. The elements of the system are used actively in the training process of the Pskov Branch, Leningrad Polytechnical Institute, in training mechanical engineers.

6521
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COMPUTER-AIDED DESIGN IN PIPE INDUSTRY

Kiev PRAVDA UKRAINY in Russian 26 Oct 86 p 3

[Article by V. Druyan, doctor of technical sciences, professor, head of the Dnepropetrovsk Metallurgical Institute Design Department and USSR Council of Ministers prize laureate: "The Computer Advises"; under the rubric: "In Competition for the Ukranian SSR State Prize"]

[Text] The problem of the wide introduction of computers and economic-mathematic methods into the sphere of economic activity is of ever greater importance, especially in the capital intensive branches, where the large product lists of production are. The pipe industry is one such branch.

The demand for high quality steel pipes constantly grows and exceeds the current capacities of pipe factories and shops. The branch has its special features: an unlimited diversity of pipe types and dimensions, and it is possible to fabricate them according to many different production flowcharts and on different equipment. Therefore, in order to choose the optimum production strategy, it is usually necessary to work out a great number of design solution alternatives.

It is then that computers come to the rescue. They allocate orders among factories and shops quickly, using the best method. With their help a project designer can determine the optimum alternative from the choices of reorganizing, technical retooling, constructing new shops or using existing shops. But it is difficult to "teach" a computer to do this.

Solving the problem of "Development and Implementation of an Optimum System for Designing and Utilizing Pipe Industry Capacities" is of urgent interest. Completion of the complex multi-plan task would be impossible without thorough analysis and broad generalizations of pipe production theory and practice, or a critical comprehension and full development of design technology with the aim of creating shops which correspond to the leading level of world technology.

The most complex economic tasks require the basic software. Original methods suggested by the authors have received recognition not only in our country, but also abroad. Research conducted in the International Institute of System Analysis has convincingly demonstrated that the methods of Soviet scientists are much more effective than those used by specialists abroad.

Perhaps on of the major merits of the work being examined is the organic unity of its mathematical algorithms with the economic and organizational pipe production scheme. Only after interaction with a computer can the need for creating new capacities in pipe production be determined. Designing a new project is also done by using a computer. With real-time modification, the capabilities of real production create the conditions for filling all customer orders.

Specialists who represent the links of the chain "science - design - production" are united in a close creative union. The enthusiasts among the larger institutes and enterprises of the country are VNITI [All-Union Scientific Research Pipe Institute], Ukrgipromez [Ukrainian State Institute of Metallurgical Plant Design], the UkSSR Academy of Sciences Institute of Cybernetics and others. Pipe factories, the first of which is the Nikopol Southpipe plant, have become a gigantic practice area ["polygon"] for the introduction of the system.

Using a developed system in the design process has perplexed even experienced specialists more than once. It is enough to remember how a new shop, using a basically new technology for thick-walled large-diameter pipe fabrication, was designed. The industrial engineers foresaw the need to install more than 70 units of equipment in the production line. They decided to determine the optimum number with the aid of a computer. Imagine the surprise when it was made clear that the assigned production plan could be fulfilled with 23 equipment positions, if correctly installed in the production line. The result was an economic impact of nearly 500,000 rubles.

Using the developed design methods in a number of shops in the Nikopol Southpipe Plant, the largest in the country, Volga Pipe and other factories, has resulted in an economic impact of more than 11 million rubles. The country has saved more than half a million tons of metal by applying production planning optimization and large-scale pipe allocation methods.

This information allows the conclusion that the work which has been performed at a high scientific level is a serious contribution to the solution of practical problems concerning intensifying and raising the efficiency of the economy.

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INTRODUCTION OF AUTOMATED DESIGN SYSTEM FOR MECHANICAL WORKING PROCESSES IN OIL FIELD EQUIPMENT PRODUCTION

Baku NARODNOYE KHOZYAYSTVO AZERBAYDZHANA in Russian No 8, Aug 86 pp 44-49

[Article by R.G. Libenson, All-Union Scientific Research and Design Engineering Institute of Petroleum Machine Building]

[Abstract] When the system for automated design of technological processes for petroleum industry machine building plants was set up, it was decided to create a collective-use system rather than creating small, scattered subdivisions at individual plants. It was further decided to base the design of the system on an existing system, rather than design it from scratch. Due to the short-run, specialized nature of petroleum equipment manufacture, it was decided to use the technological process design system for mechanical working developed by the Scientific Research Institute of Cryogenic Machinery Manufacture as a model. A data base of capabilities of manufacturing equipment at each member plant was created. Major trends in the improvement of the manufacturing system included improvement in the structure of part descriptions, introduction of logical and geometric testing of the descriptions of parts, introduction of technological and structural monitoring of information files, analysis of the question of expediency of direct formulation of standards and reference data, development of algorithms and programs for rapid information retrieval, development of algorithms and programs to eliminate the use of standard tolerances, development of a set of programs to organize, store and edit output files to allow correction of notations following analysis, development of additional programs to generate equipment lists, operational cards and other documents, and development of a system of programs to calculate tool consumption standards. The basis of the algorithm used is definition of mechanical working operations as an organizational and technological category concentrating treatment of a certain group of surfaces at a single working location with a single mounting of part and adjustment of the tool. The system has been used for design of technological documentation of 8,000 parts manufactured at eight petroleum industry machine building plants. The structure of the system allows further improvement based on experience gained in industrial application of the system.

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REVIEW OF HANDBOOK ON PRODUCTION PLANNING USING AUTOMATED MANAGEMENT SYSTEMS

Moscow EKONOMIKA I MATEMATICHESKIYE METODY in Russian Vol 22, No 4, Jul-Aug 1986 pp 755-756

[Review by V.I. Danilin of book "Planirovaniye proizvodstva v usloviyakh ASU (Spravochnik)" [Production Planning Using Automated Management Systems (A Handbook)] by K.F. Yeefetova, T.P. Podchasova, V.M. Portugal, and B.E. Trinchuk, Tekhnika, Kiev, 1984, 135 pp]

[Text] Well-known works on the questions of improving the methodology of planning shed light, as a rule, on individual types of planning under conditions of using automated management systems (ASU's), and give greater attention to the theoretical aspects of the problem than to the requirements of production. At the same time, for the past decade certain experience in employing mathematical methods in planning has been accumulated. For this reason, it has become possible to generalize them and formulate recommendations for ASU developers and economists of industrial plants.

These circumstances make the publication of the handbook under review, which summarizes this experience and is addressed to a wide circle of readers — "users" of economic and mathematical methods in planning — very timely. The merit of this book is in its overall consideration of all aspects of planning, beginning with long-range planning and ending with daily-shift planning; accordingly, the book is divided into seven chapters.

Chapter 1 reveals in detail the mathematical methods which are used in long-range planning of plant activity, whose role is constantly increasing in the current stage. Methods of technical and economic calculations, extrapolation methods, multivariate correlation and regression analysis, expert evaluations, and so forth, are presented for implementing long-term planning. Unfortunately, the handbook lacks a description of a large class of optimizing models, based on a normative approach and used during the development of five-year plans. (Footnote) (These models are seen for example in "Ekonomiko-matematicheskiye modeli v sisteme upravleniya predpriyatiyami" [Economic and mathematical models in a system for plant management] Moscow, Nauka, 1983)

The book describes current planning at a plant, its interconnection with the five-year plan and long-range planning, and the models applied in practice (Chapter 2). There is a detailed examination of models for formulating

individual divisions of the industrial manufacturing finance plan, in particular production planning, but at the same time a number of its divisions (for example financial planning) are not at all within the authors' field of vision. The book reflects the experience of the operation of technical and economic planning subsystems at a number of the country's leading plants.

Models for formulating the production program of a plant occupy a special place. For convenience, they are classified according to the types of production, the duration of the product manufacturing cycle, and the conditions for realizing production. However, the classification of these models is not carried out from the standpoint of the factors considered in them, which somewhat lessens the completeness of their description.

Here the data base for the tasks of on-going production planning is characterized. All data necessary for calculating the plan is subdivided into three types: normative; data regarding the possibilities for production in the base period; and the general system data. Principal attention is allotted to the creation of a normative basis for calculating the variants of the plan. This section, in our opinion, is one of the most interesting and useful.

The significance of the normative basis for planning is generally well known. The handbook describes the contents, organization of the on-going renovation, and methodology of deriving each group of norms. The material appears sufficiently general and can provide substantial assistance to designers of on-going planning systems at various types of plants.

The book also looks in detail at operational production planning for them (Chapter 3). It provides a diagram of an operational production planning system, and analyzes in detail the factors which influence the choice of a planning system and the indicators which define the production type. This chapter identifies the place of each model presented in subsequent chapters in the general scheme of operational production planning.

The handbook illuminates the properties of inter-shop planning automation (Chapter 4). The authors present a number of recent, original results: the choice of a planned accounting unit for inter-shop planning, the refinement of the list of its tasks, and the development of their models. Great attention is given to models of this type of planning for various types of production, and to the corresponding standard packages of application programs.

When describing an automated system of intra-shop planning (Chapter 5), the book gives a detailed overview of the tasks of accounting plan structure and analysis and the operational management of the production cycle. Besides the models for formulating a production program and for calendar planning of the work of the sections and so forth, there are also descriptions of the application program packages which implement intra-shop planning.

Special attention is given to problems of calendar planning of production, and to the more typical tasks and algorithms for their resolution (Chapter 6).

Various precedence functions and their classification, proposed for solving the practical problems of composing calendar plans on a computer, are expounded in detail.

In Chapters 4 to 6, models of operational production planning are analyzed, but practically no attention is given to questions of constructing combinations of economic-mathematical models based on them, although this is, at this time, a fundamental direction of modeling planning activity.

The choice of a management subsystem for production engineering and for material-technical supply (Chapter 7) is a definite item of interest. Here the book illuminates the principles of creating adaptive systems of production engineering, and the organization of a planning system and a system for operational regulation of the material-technical supply, but less fully than, for example, the annual and operational production planning. The authors limited themselves to a very compressed list of the most important aspects of modeling these subsystems.

Evaluating the book in its entirety, one can affirm that it has succeeded in systematically presenting a great amount of material about modeling planning activity at a plant, and in combining the necessary theoretical depth with the practical direction of the exposition. In our opinion, the handbook allows one to pick the model (or models) appropriate to every type of planning and choose for it (them) standard software in the majority of cases. The book is well formulated, including a wide list of recommended literature. Undoubtedly it will prove useful to specialists engaged in the questions of planning production.

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NETWORKS

BUDAPEST-LENINGRAD COMMUNICATION CHANNEL

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 14, 22 Jul-4 Aug 86 p 2

[Unattributed article under the rubric: "NTR Pulse"]

[Text] Leningrad cybernetics workers and their Hungarian colleagues are actively cooperating in the area of robotics, flexible automated systems and the development of artificial intelligence.

The computer communication channel between Budapest and Leningrad, operated by the specialists of the Computer Technology and Automation Institute of the Hungarian Academy of Sciences and the Institute of Informatics and Automation of the USSR Academy of Sciences, is a model of future unified computer networks of CEMA country-members.

In the photographs: during one of the Leningrad-Budapest communications sessions. In the foreground - engineer-programmer Olga Smirnova and Natalya Ponomareva, senior scientific associate of the Institute of Informatics and Automation USSR Academy of Sciences; Vladimir Nikolaevich Konoplev, section head of the Institute of Informatics and Automation of the USSR Academy of Sciences. Photographs S. Smolskiy. [Photographs not reproduced.]

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EDUCATION

INFORMATICS AND THE NATIONAL INFORMATION RESOURCE

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 5, May 86, p 21

[Article by I. Chebotaru, director of the Republic InterVUZ Computer Center]

[Text] "...The truly new technology of information processing requires new procedures for bringing about solutions... In my opinion, a person who does not want to subject his actions to computer verification does not understand the entire extent of the responsibility which he took upon himself when he became a person responsible for decision-making." (Academician N.N. Moiseyev)

The strategy of the CPSU for accelerating the social-economic development of the nation based on scientific-technical progress presupposes the maximal mobilization of all our material, energy, labor and information resources and reserves. The use of information resources has particular, fundamental significance, as only these, in contrast to material resources, have the unique characteristic of not only not diminishing with intensive use, but, on the contrary, of multiplying.

That is why it was emphasized at the 27th CPSU Congress that computer technology and the industry of informatics, besides machine-tool and instrument making, are genuine catalysts in the acceleration of scientific-technical progress.

At present, informatics is a science concerned with the control of information processes.

If the knowledge a person receives is utilized in bringing about solutions, then it becomes information for him. If this knowledge is not directly utilized in bringing about solutions, but is accumulated for possible use in specific, foreseeable situations, it becomes so-called potential information. Knowledge which is not utilized in adopting solutions and has no foreseeable use, then becomes so-called information "noise." It is impossible to decide in advance whether specific reports or data will become information. That depends upon what the problem to be solved is and for what solution the information will be used.

In order for information to be accepted, it is necessary that it adopt a material form, that it be represented in some information medium. In the

world surrounding us there are many types of information media. For example, air, in the form of sound waves, is a medium for audible information; energy, in the form of electromagnetic waves, is a medium for visual information. Until recent times, the basic long-term medium for information was paper, in the form of various documents, books, etc. Now, magnetic tapes and diskettes are utilized more and more in the capacity of information media. And electronic computers have become the basic instrument for the automation of the processing of information represented in these media. In recent times, these electronic machines have come to be known as computers (from the English word "computer"). In this connection, the process of introducing into the diversity of human endeavor the ways and means of processing information with the aid of computers is now known as computerization.

In the most recent quarter of this century information has become the basic subject of labor for most workers in the most diverse branches of the economy. Information is also the result of their labor. This information is a wealth of a new type: The so-called national information resource.

It is considered that the ratio of the size of the part of the national information resource comprising iuformation used for automated searches, storage and processing to the total size of this resource is one of the essential economic indexes that characterize the effectiveness of the utilization of this most important national resource. Widescale intensification of all types of human endeavor based on the application of scientific-technical results in general, and by means of the computer in particular, facilitates an increase in this index. In this same manner, the computer will become one of the fundamental factors in the growth of labor productivity in the realm of management as well as in the realm of material production. Therefore, information models of production enterprises, associations and entire branches of industry have found wide application in recent years, forming the nucleus of so-called automated information management systems.

To arm man with these fundamentally new means of production, intensifying his intellectual potential, is one of the most important tasks of the modern stage of the development of our society. But wide introduction of computers into the economy must take place in parallel with the education of the population in computer literacy. It is with this aim that this article begins with the new rubric of the journal "The Computer - To Arm the Manager and Specialist." In this journal, we plan to publish a series of articles in which concrete aspects of informatics or the concrete area of its application in the system of the agro-industrial complex will be discussed.

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HARDWARE FOR AUTOMATED INFORMATION PROCESSING

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 6, Jun 86 p 19

[Second installment of article under the rubric: "Computer - To Arm the Manager and the Specialist," by I. Chebotaru, director of the InterVUZ Computer Center of the MSSR Ministry of Higher and Secondary Specialized Education, and K. Galben, chief engineer of the Project for the Collective-Use Computer System of the MSSR Ministry of Higher and Secondary Specialized Education]

[Text] The utilization of information resources is connected to a growing degree with the effective instrument of information processing, the electronic computer.

The realization of information processing using the computer presupposes the computer's interaction with its human user. The very fact that every computer must be oriented towards a human interface determines all of the computer's characteristics and requires a certain conception of the instrument by the user.

First of all, he must know that every computer consists of separate devices which interact by means of physical connections.

The basic devices comprising the computer are the processor, the main memory and the peripheral devices. Peripherals are divided into external memory and input-output devices.

The processor is a device responsible for the processing of data (information) in a program assigned by the human user. The processor receives the program and the data to be processed in it from its main memory.

Main memory is a device which stores the programs and the data they process. The results of the processing are also placed in main memory.

Peripheral memory devices fulfill the function of a storage place for automatically accessible data, in quantities hundreds of times larger than human memory. Removable data media in the form of magnetic packs or tapes allow the accumulation of archives of data that can be measured in billions of typewritten pages of information.

Devices for the input and output of data are responsible for the interaction of the computer with the user.

At present, basically the following input-output devices are utilized: punch cards, alphanumeric printers, displays and devices for input-output onto floppy disks.

These devices may be employed by the computer in various combinations. But the computer must necessarily contain a minimum of means by which data may be exchanged with the human operator. Today, such a minimal set of devices most often consists of a keyboard, like that of a typewriter, and/or a printer and a video display - a device with a television screen, on which lines of letters, numbers and other symbols are illuminated.

One of the various types of computers is called the personal computer. We would note, and it is important, that this type has all the characteristics of a computer. In particular, the personal computer must have a means for exchanging information with the human operator (today, as a rule, that includes a keyboard and video display, and in the near future a means for voice recognition) and external memory. In the majority of cases in personal computers, cassette tape recorders and floppy disk drives are used as external memory devices.

Everything we have examined until now has referred to the so-called hardware of the computer. However, hardware can do nothing by itself. Another most valuable, inseparable part of the computer is the computer's software. With the aid of software provided with the computer, the user develops specialized software for the solution of concrete technical engineering problems. We will indicate those which refer to the activities of an agro-industrial association.

They consist of managing the technological process of large cattle and poultry-breeding complexes, mixed feed production, greenhouses, enterprises, post-harvest processing and storage of grain, cotton, sugar beet and other cultures, control of water distribution networks, agrochemical information systems, certain structures for the tractor fleet and planning of its use; development of annual and five-year optimized plans, etc.

Thus, automated processing of information with the aid of the computer facilitates the intensification of human endeavor in the realm of planning and management, and leads to an increase in the quality and effectiveness of the accepted solutions.

The stages of solving any problem using a computer will be examined in the next article.

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HOW TO SOLVE A PROBLEM ON A COMPUTER

Kishinev SELSKOYE KHOZYAYSTVO MOLDAVII in Russian No 7, Jul 86 p 19

[Third installment of article under the rubric: "Computer - To Arm the Manager and the Specialist," by I. Chebotaru, director of the Republic InterVUZ Computer Center, and N. Galushka, manager of the Computer Center Department]

[Text] Earlier, we spoke of the role of the computer in the processing of information. In this article we will show the stages through which the raw information passes in obtaining the result of the solution of a problem on a computer.

The statement of the problem is the first stage of this process. The goal for the solution of the problem is formulated and its contents are described in detail. The character and essence of all values used in the problem are analyzed, and the conditions in which it is to be solved are determined. The statement of the problem, as a rule, is performed by a specialist in the specific area from which the problem is taken.

Next begins the stage of mathematical formulation of the problem, in which the initial data and the scope of their changes are determined, and the conditions of the problem are described with the aid of mathematical symbols. In other words, a mathematical model of the problem is formulated. The mathematical apparatus to be applied at this stage depends on the type and specifics of the problem. Mathematical formulation of the problem is performed by specialists in mathematics. The practice of problem solving has shown that a greater effect is observed when the first two stages are carried out jointly by specialists in mathematics and specialists in the area of the problem.

Utilization of a specific numerical method leads the solution of the problem to an ordered execution of the four arithmetic actions and logical operations. Therefore, the next stage in the solution of the problem shall be called the selection and justification of the method for the solution of the problem. In denoting the method it is necessary to consider, in addition to the basic requirements of the problem, the precision of the computations, the computer time for the solution of the problem, etc. In some cases, the suitability of the chosen method may be established only in the later stages. When the

chosen method is revealed to be unsuitable, it is necessary to return to the stage of selection and justification of the method. This stage is to be carried out by the specialist in mathematics.

The next stage consists of composing the algorithm for solution of the problem. The process of treatment of the initial information is broken up into independent elements for computation, and the sequence for their computation is established in accordance with the chosen method. In order to reveal the interconnections of these elements, an algorithm is worked out for the solution of the problem. At this level the correctness of the algorithm is verified to be within the possible limits of logic. The work in algorithmization of the solution of the problem is performed by programmers.

Next is the stage of composing the program - the algorithm for the solution of the problem described in a language understandable to the computer. Such a description of the algorithm is translated to one of the programming languages with the aid of specialists in information media systems (punched cards, punched tape, magnetic tape or magnetic disk). The algorithm for the solution of the problem, described in the programming language and transferred to an information medium, may now be employed for development on the computer.

Developing the program on the computer pursues the following aims: control of the program, and detection, determination and correction of errors. The elimination of incorrect elements in the program is called debugging. Large programs are divided into parts, with as few connections between them as possible. The correctness of the computation is verified separately for each part. That is, so-called autonomous debugging is conducted. After the errors are eliminated, the program is debugged in whole: Several examples are worked through in this manner, in order to verify that the separate parts of the debugged program work together. This is a labor-consuming stage, in which the programmer's first commandment should not be forgotten: "Every last error found is really the next-to-last."

After debugging the program, and after preparation and verification of the initial data comes the stage of solution of the problem on the computer.

Solution of problems by computer takes place automatically after loading the program and the initial data into the computer. However, during the solution of the problems, the operator must be present at the console, as he can interrupt the operation of the machine if unforeseeen or impermissible situations arise. The operator follows instructions set forth in advance by the programmer - the developer of the program.

The results obtained in solving the problem on the computer are analyzed and evaluated by the specialist who had stated the problem jointly with the mathematician and programmer.

Examples of solving concrete problems from branches of the economy will be examined in subsequent articles.

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PROGRAMMING SCHOOL

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by G. Grigas, candidate of technical sciences, and V. Dagene, scientific associate; first paragraph in source in italics]

[Text] Many graduates of the correspondence "Young Programmer's School," organized by the Mathematics and Cybernetics Institute of the Lithuanian AN [Academy of Sciences] and the republic youth newspaper, have become quite friendly with computers.

The "Young Programmer's School" (ShMP) is open to all interested persons. There is a large number of them, as practice has shown: In each group there are 1,500 people, the majority of whom are in republic high schools. They take an active part in solving problems assigned through the newspaper. In correspondence programming courses we are striving to provide the necessary knowledge in this discipline, to develop skills in algorithmic thinking and to teach an approach to creating programs which solve simple problems. Preference is given to practical questions, as our students acquire theoretical knowledge in the process of generalizing practical assignments.

Programming instruction at ShMP is divided into two parts: programming principles, to which 6 months are allotted and programming basics, to which 18 months are allotted.

Programming principles is a survey course designed to familiarize all students with programming. This course's lessons are published in the republic "Komsomolskaya Pravda" from September to December, one lesson per week. Students are given four to five graded assignments, each containing three problems. Each assignment is to be completed in one week.

Programming basics is a more fundamental study of the discipline. Those ShMP students who have successfully mastered programming principles may enter this course. The course materials and assignments are mailed out each month. In all, 12 graded assignments are given for completion in the programming basics course.

To aid students, the ShMP has developed and published course materials: instructional materials, problem sets and a manual on the Pascal language.

Each year we organize summer camps and meetings in various cities of the republic for our students. Olympics are held and there are contests for the best program for one's own problem.

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'PYRAMID' MICROCOMPUTER FOR TRAINING

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 16, 19 Aug-1 Sep 86 p 6

[Article by S. Pavlova: "The Universal Pyramid"; first paragraph in source in italics]

[Text] An original training computing complex has been developed by Moscow Institute of Electronics Technology teachers and students.

"The basis of our 'Pyramid' is a training microcomputer housed on one open board," relates D.I. Panfilov, candidate of technical sciences and docent of the Electrotechnology Department, one of the initiators and authors of the design.

Additional boards, each of which performs a specific function, go into "Pyramid." Board construction is also open, so any of them can be the subject of separate research while operating in conjunction with the microcomputer. "Pyramid" has yet another property: It can be disassembled. All the circuit boards are easily joined with each other. Consequently, some can be removed and, when necessary, replace others. In other words, just as it is possible to construct little houses of varying architecture from nursery building blocks, it is possible to "assemble" a microcomputer from a selection of electronic boards with varying designated properties. In point of fact, at the basis of "Pyramid" is the ever-familiar operating principle of nursery construction which, for all its fascination, is still an exceptionally useful game, developing expression and independent thought and revealing individuality and a proclivity for creativity.

The complex is not called "Pyramid" by chance. Knowledge of what is new proceeds from day to day, from foundation to summit, from the simple to the complex. With its help, it is possible to learn circuit features and the software of microcomputer systems, to master practical methods of detecting faults in the device and to learn to model the operation of different units. Moreover, "Pyramid" can work as a control panel for very different devices: a television, common tape recorder, display and plotter or robot unit. Joining the computer with any peripheral device is done through the so-called interface unit, which can also be removed if necessary. In one word, "Pyramid" is universal--invent, create!

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COMPUTER USE IN TEACHING SOCIAL SCIENCES URGED

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 12: TEORIYA NAUCHNOGO KOMMUNIZMA in Russian No 4, 1986 (received by editors 31 Mar 86) pp 55-61

[Article by T.V. Belova: "Computers in Teaching Scientific Communism"]

[Text] The basic directions of the country's economic and social development over the current 5-year period and over the period up to the year 2000 has set the task of "substantially improving the supply of up-to-date instruments, equipment, automation equipment, and computers to organizations and higher educational institutions."[1] There is much yet to be done even in this direction. The introduction of computers into all spheres of the life of society is an important feature of the scientific-technical revolution we are experiencing. The dissemination and widespread assimilation of computer technology and the gradual transformation of computers into an everyday phenomenon constitute an invariable condition of the intensification of all social processes, including the process of teaching in higher education. Step-by-step computerization has become an integral part of the reorganization of higher education and of improvement of the training of future specialists.

There are, of course, a number of reasons why computerization cannot take place at anything like the same rate in all higher educational institutions. Compared to the natural and technical sciences, the humanities do not lend themselves so well to formalization, to quantitative description, and probably not to the fast and broad application of computers either. Moreover, established traditions in teaching are also an obstacle to a certain extent to application of advanced achievements of science and technology to the teaching process.

At present scientific-technical progress is influencing courses in the social disciplines, scientific communism in particular, along just one line: examination of the nature, historical role, and consequences of the scientific-technical revolution is a subject taken up under certain topics. This direction in teaching should clearly be improved still further. Yet, as emphasized in the new version of the CPSU Program, the scientific-technical revolution is having a powerful impact not only on present-day production, but indeed on the entire system of social relations, on man himself, and it is opening up new prospects for a substantial rise in the productivity of labor and for progress of society as a whole.[2] It follows therefore that the NTR should be not only

a subject of study, but also a teaching tool, the means of achieving higher effectiveness of all forms of teaching, of improving the quality of assimilation of knowledge by students with a smaller investment of time.

The present-day situation in the flow of information in the social sciences is characterized by very rapid change in quality and quantity. Some people refer to this situation as the information explosion, others as the information crisis, and still others as the information revolution. But whatever name is given to this phenomenon, one thing is clear--it is difficult even for a specialist to get his bearings in the flow of so much information, not to mention a student. Accordingly, a different level of control over the process of the inflow of knowledge in the social sciences is demanded of personnel in higher education, social scientists first of all. We are referring not only to a change in teaching style and methods, but in fact to a transformation of the very character of the educational process on the basis of recent advances of science and technology. As computers make their way into all spheres of human activity, working major changes in the content and character of work, they offer immense opportunities for the process of teaching related to the sciences which embody a world outlook. Today the computer is taking on an active role in the academic high school. In the light of the requirements of the reform it is bringing about a fundamental change in the quality of its performance, the students themselves are active in acquiring knowledge, it is speeding up the pace of thought considerably, and it is saving the time and energy of schoolchildren in satisfying their intellectual needs and enthusiasm.

The times demand a qualitative improvement of teaching in higher education as well. The task of personnel in higher education is not to trust exclusively in recommendations from above, but to take advantage of the strategy offered by the party, the strategy of large-scale experimentation.

In our view it is permissible to use computers in teaching on the basis of critical analysis and foreign know-how. We cannot, of course, merely copy the tricks, falsifications, and other con men's deceptions practiced by bourgeois propaganda. It is important to make use of what can "work" to our interest.

The use of computers in teaching the social sciences is something inevitable. You sometimes hear the expression: "What is there to talk about unless we see these machines with our own eyes?" First of all, computers do exist in a number of VUZ, including MGU. Second, where they do not exist as yet, people should be ready to encounter the computer. And this preparation must be made both through familiarization with the computer, with the way it is made, through an introduction in the form of a seminar required for social scientists who teach the course in informatics, as well as by teaching programming. It would seem that the method of programming without the computer, which has been proposed by the secondary school system, opens up large opportunities for elementary training for interaction with the computer. This method also holds promise for VUZ teachers. It meets the requirement which was advanced back at the June (1983) Plenum of the CPSU Central Committee--of "accomplishing the broadest use of computers."[3]

As in any new thing, the two extremes are undesirable here: exaggerating the role of computers in the educational process, and, conversely, conservative nihilism in their use. Of course, one cannot concur in the view which is widespread in the West that teaching is undergoing radical modification in the present world, that the "conventional system based on classroom exercises and personal involvement of the teacher will be replaced by programmed learning accomplished with an entirely informatized system."* Even where the necessary physical facilities are in place, computerization must take place gradually, adjusted to the particular teachers of the topic outline of the course in scientific communism. A thorough analysis is needed as to what aspects of the topic being studied can be turned over to a machine that does the teaching and the checking. To lose a sense of measure threatens a game of definition, the substitution of freewheeling operation with the set of categories, stochastic schematization.

Use of the computer presupposes a step beyond the customary ideas about the teaching process. Here the number of work stations connected to the machine may be large, and the questions put to each user may be individual. The automatic teaching machine is far more patient than the teacher, and the learner becomes less upset when he makes a wrong answer. The computer can impart a large amount of sound knowledge to students. That kind of advantage is very important, since man's present-day development demands that an ever larger quantity of knowledge be accommodated in an ever smaller quantity of information. One can therefore forecast that the traditional textbook will come to the end of its usefulness as a means of learning in the era of the scientific-technical revolution.

Computerization in scientific communism results in a change in the forms of the teaching effort. The teacher will be freed of numerous repetitions, he can lead the discussions instead of repeatedly listening to correct and incorrect answers. As it changes the techniques of data processing and data acquisition, the computer will stimulate the research effort of teachers to compile saturated teaching syllabi.

At the same time we must also take into account the computer's capabilities. For instance, its ability to analyze new incoming information is limited. For example, the less familiar the situation is to the computer, the less reliable its answers, the more identical information it will accumulate and the more stereotyped its forecasts and recommendations will be. The computer also has another shortcoming--the inability to determine the content of new incoming data with sufficient reliability. As a result its memory inevitably becomes cluttered with superfluous information, and yet the computer is unable to realize that this information is unnecessary and sometimes even harmful. We should also remember that the computer is only a tool of man's intellectual action. Bad teaching programs will not be beneficial, but will be harmful; they could result in a standardization of thinking. The computer replicates the teacher's skill by including his knowledge and professional experience in the knowledge base. That is why it is so important here that the computer be introduced into the teaching process by stages. We need to be clear on the point that it is not the computer that defines man's world outlook; it is possible to gain knowledge with its help, but no more than that. Building a man's

character, shaping his convictions, the evolution of his moral and political positions are achieved mainly on the basis of the teacher's live intercourse with the student on the basis of confidence. Only in that way does the student come to the point of independently building himself.

The computer affords the teacher the possibility of broadening the framework in which problems are studied, of imparting to the students a greater interest in acquiring knowledge. This motivation occurs on the basis of the teacher's examination of the problems that exist, the contradictions in social development, and a presentation of the directions of the scientific exploration to resolve them.

The use of computers must comply with the humanistic parameters of values, the ethics, and the rights and duties of man in a socialist society. For example, N.N. Moiseyev, member of the academy, and I.T. Frolov, corresponding member, emphasize, for example, that "the new means of transmitting and analyzing information may prove to be a key to executing programs for restructuring a man's scale of values."[5]

The possibilities for the use of computers in teaching the social sciences are based on the most characteristic attributes inherent in present-day computers. The essence of them lies in the following: 1) in the possibility of timely and effective use of present-day information on the basis of the speed characteristics of the computer; 2) in the ability to "play out" logical problems by using a proposed model, the ability to reproduce differing points of view, to find the right answers by checking the proofs.

Two directions for applying computers in teaching scientific communism and other social science disciplines follow logically from the capabilities of the computer enumerated above. The first direction gives to the computer the role of an information and consulting service. Something can be learned here from the experience of the Fundamental Library on the Social Sciences, where a state data bank making it possible to use a computer catalogue is being set up. VUZ's which have the physical facilities for computerization plug in to the information service system. For instance, the Moscow Physical Engineering Institute is making a vigorous effort to involve the terminal information system connected to INION in the practical work with students. Any teacher, associate, or student can in a few minutes obtain information on the literature available on each of the topics being studied and on the basis of that communication will have a printout at his disposition. To be sure, many people still have to resort to the services of the engineer attending the terminal information system for the social sciences (TITsION). There is a need, then, to develop informatic literacy in computer users. This will be greatly furthered by the course in informatics taken by teachers of the social sciences, by workshops in mastering the skills of operating computers. Many social science teachers are working out projects for consultations on particular topics in the syllabus. During such a consultation the computer can convey to the students the main body of knowledge and conclusions which are not subject to discussion and which for one reason or another have not been previously assimilated by the students.

The second direction for the use of computers is to create learning programs on the basis of a data bank. It is clear that the computer itself does not select from textbooks the body of knowledge which it furnishes. The computer accomplishes the acquisition of knowledge in a network of connections between the principals. Here one of the principals is the student, who clarifies the internal dependent relationships of the proposed phenomenon, and the other is the teacher, who proposes the information bank. As is well known, information is knowledge obtained on the basis of data. It is the teacher's job to process the data, which means putting it in the form that is most suitable for the information to be extracted from it. Moreover, the maximum information should be extracted from a minimum amount of data. Data banks pass through a triple filter in order to be perceived and to become information: a physical filter (constraints on the throughput of the channel), a semantic filter (brief, straightforward, and very limited sets of terms, creation of model, standard thesauruses), and a pragmatic filter (appraisal of the usefulness of the data).

It is thought by some that social phenomena cannot be placed in the framework of structures in formalogic and abstract mathematics, in tables, and matrices. This assertion is too categorical. V.Zh. Kelle proposes that the way out of this be "sought by differentiating the different types of social knowledge, specifically distinguishing between knowledge of the social humanities and social knowledge."[6] The latter in his opinion is closer to natural science, although it does require an appropriate qualitative interpretation in order to clarify the social meaning. Quantitative methods, formal diagrams, and abstract models play a subordinate and auxiliary role in the former meaning of the term. In its reliability and strict causality of clarification and forecasting a social science does not fall short of the precise sciences.

The essence of programming social knowledge consists of presenting the subject matter not in a stream of information, but in arranging it into steps. In answering successive questions the student reaches the conclusion on his own.

The large number of problems and exercises in the social sciences which have now been proposed and which have been published in many VUZ's can serve as the base that is necessary for programming. The problem consists of conceptualizing the experience, of distinguishing the key questions which run through all the topics in the course on scientific communism. The problems to be clarified and selection of the right solution can easily be adapted for use on computers. Many people rightly feel that in view of the emergence of a large number of different collections of problems and exercises there is a greater need for psychological-pedagogic analysis of the practice of their use in teaching.[7] Moreover, a mathematical-cybernetic analysis is also indispensable when teaching machines are used. Constant communication with the engineering departments needs to be established, and a laboratory set up that will bring together social scientists, engineers attending the computer, and mathematician-programmers.

Teachers of the social sciences will have a larger role to play in preparing the program as the use of computers in teaching expands in the future. The effort in that direction should begin even now. In our view it would be

advisable to this end for the Ministry of Higher and Secondary Specialized Education to set up a center that would coordinate the activity of social scientists in writing programs in the social disciplines.

Competent specialists should be enlisted for this work. After all, the programs must be saturated to the limit with information. What we are actually talking about is the problem of building a model of the course in the various social sciences. Building a model of a particular topic presupposes aggregation and unification of related elements to form larger units. At this point it would be up to the specialist to decide which of the elements of knowledge are the most important. Although such a model can give only an approximate description of the process being studied, the aggregation is indispensable. Once created, the model would not correspond to the original in general, but with respect to those of its characteristics which are the most important for the researcher. For instance, building a model of the topic devoted to the theory of the socialist revolution, to the content of the present era, requires aggregation of the principal component determining the nature of such a revolution and the basic content of our era.

One of the goals of computer teaching is for the students to assimilate normative (prescriptive) models of responses designed for attainment of the optimum state of the total body of knowledge. In this case we get a closed model which seems to be isolated from the environment. It may be only a scientific abstraction that helps in studying the patterns of a real society in accordance with a simplified version. The behavior of such a model is determined not by external factors, but by the initial state and internal patterns of its development. That kind of isolation is, of course, very hypothetical; as a matter of fact the system is always open because of the universal interconnectedness of social processes. And that is why it would be a mistake to reduce the program of work on teaching machines to the assimilation and free handling of normative models. The latter can and should be fitted into an explanatory scheme and supplemented with descriptive models which analyze the facts. The optimum version of an explanatory scheme is found by "capsulizing" the specific features of a particular piece of knowledge in its abstract-logical forms. The explanatory scheme is a reliable guarantee of the objective truthfulness of the model. For example, the fight for democracy as an integral part of the fight for socialism might be represented in the form of an explanatory scheme. Such a model would include definition of at least three elements of objective processes: 1) the basic content of the fight for democracy; 2) the connection between the fight for democracy and the fight for socialism; 3) the insufficiency of the fight for democracy for the purpose of establishing socialism. The normative model is assimilated more firmly, and the knowledge becomes more dynamic, if criticism of non-Marxist models of the fight for democracy from the standpoint of the prospects for socialism is given as the second assignment. The purpose of this kind of study is a thorough understanding of the inadequacy of the fight to establish democracy for the purpose of establishing socialism, the inevitability that adherents of conceptions of "democratic socialism" will slip back to a policy of reconciliation with the existing political system of capitalism.

The process of computer-aided teaching goes like this: The teaching machine displays a brief instruction and puts a question. The user selects one of the proposed answers or fills in blanks in the text. The computer evaluates the correctness of the answer. If it is wrong, then the computer either takes the user back to an earlier stage of learning or gives the correct answer. When computers like this are used, a distinction should be made between the putting of a question as part of the teaching process and putting it at the end of the process. In the former case the user, relying on material already learned, should by logical conclusions find the correct answer with the computer's help, while in the latter case this material serves only to reinforce the knowledge acquired. Depending on the programs used, these computers can be divided into two types: the first type uses linear unbranched programs whose course the user cannot influence. He is asked to choose one of several alternatives from a set of those which are possible. Making a decision requires clear formulation of the objective, compiling a list of alternative possibilities and defining the rules governing choice among them, and knowing the factors which can influence the result of the taking of a particular decision. The difficulty here is that this kind of situation may be grasped not as the result of analytical scanning of the different versions with respect to the objective, but as the result of synthetic insight, a sudden intuitive grasp of the idea behind the decision looked for. Electronic cheating, which has been quite often observed in the West, is also possible here.[8] Knowing how a program operates, certain users who know about computers determine the position of the correct answer and use it for their own purposes. That is why problems involving choosing the correct answer from several that are proposed cannot be a form of learning, but figure only as a way of testing existing knowledge. At the same time, every student can check his knowledge of topics studied previously.

The second type of program is one that is branched, so that if the user does not find the correct answer, the program branches, and that makes it possible to fill the gap in his knowledge. The student using this type of program conducts what is called genetic analysis; that is, he examines the process from the standpoint of its occurrence and development. This gives the students greater interest in the problem area being studied. The exploratory and creative factors in learning are broadened by means of the computer, and individualization of learning exercises is achieved. Branched programs presuppose that clarification of the topic is both complete and comprehensive, and they require not separation, but unification of the philosophical, sociopolitical, historical, and economic aspects of the problem area being studied. They create the prerequisites thereby for eliminating duplication in the teaching of the social sciences.

Teachers of all social science departments must take part in writing the programs for teaching machines; that is, interdepartmental integration is indispensable here.

Thus the new teaching technology inevitably involves intensification of teaching activity and alters the forms which social scientists use in their work. By broadening the forms and methods of teaching, the computer raises the issue of the increased role of the social scientist's personality. Unfortunately,

little attention is still being paid to the teacher's ability to participate in arguments, to be convincing, to get his bearings in the things that particularly interest and excite young people. The times demand a greater general sophistication and erudition on the part of the teacher, and ability to respond to many questions, including those which lie outside the limits of the subject.

In summing up what we have said, we should note that reality is urgently and irrepressibly demanding that the reorganizational and methods aspects of teaching be revamped and refined and that these efforts keep pace with scientific-technical progress. There are, of course, difficulties along this road, including difficulties in the area of computer application to teaching the social sciences. On the one hand they have to do with the fact that the computer is still not reliable enough and there has not been enough experience in operating it and taking care of it. On the other hand, social scientists are still not mentally ready to use the new technology. The very posing of the question of using computers in teaching arouses internal resistance on the part of many people. That is why we need a psychological reorientation here above all. The problems of a radical restructuring of syllabi, of reassessing the teaching load on teachers, and of changing the style of leadership of academic departments are also being put on the agenda.

"Scientific-technical progress," it was emphasized at the June conference (1985) held in the headquarters of the CPSU Central Committee, "is a vitally important phenomenon; it responds to the interests of all and makes it possible for everyone to discover his abilities and talent on a broad basis."[9] This also applies to VUZ's. It seems to us that the leading VUZ's of the country, MGU first of all, must design and conduct well-thought-out and substantiated experiments in the use of computers in teaching. The favorable results obtained in the process of such experiments will provide the basis for major transformations in teaching scientific communism.

FOOTNOTES

1. "Materialy XXVII syezda Kommunisticheskoy partii Sovetskogo Soyuza" [Materials of the 27th CPSU Congress], Moscow, 1986, p 284.

2. Ibid., p 141.

3. "Materialy Plenuma Tsentralnogo Komiteta KPSS, 14-15 iyunya 1983 g." [Materials of the Plenum of the CPSU Central Committee Held 14-15 June 1983], Moscow, 1983, p 10.

4. Quoted in G.Kh. Shakhnazarov, "Kuda idet chelovechestvo" [Where Is Humanity Headed], Moscow, 1985, p 73.

5. VOPROSY FILISOFII, No 9, 1984, p 26.

6. "Teoriya otrazheniya i obshchestvoznaniye" [The Theory of Reflection and Social Science], Sofia, 1973, p 259.

7. "Problemnyy metod prepodavaniya nauchnogo kommunizma" [The Problem Method of Teaching Scientific Communism], Moscow, 1984, pp 100-101.

8. FILOSOFSKIYE NAUKI, No 2, 1984, p 65.

9. M.S. Gorbachev, "Korennoy vopros ekonomicheskoy politiki partii" [The Fundamental Issue in the Party's Economic Policy], Moscow, 1985, p 31.

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NEW JOURNAL 'INFORMATICS AND EDUCATION' PUBLISHED

Moscow NTR: PROBLEMY I RESHENIYA in Russian No 19, 7-20 Oct 86 p 2

[Article by S. Khozin: "To the Teacher and the Student"; first paragraph in source in italics]

[Text] The first issue of the journal "Informatics and Education" has appeared.

Today's students will arrive tomorrow at the laboratory and workshop where contemporary computer technology awaits them. The computer will arrive in the school in the next few years. Confronting Soviet teachers is the task of introducing into pedagogical practice a new course on informatics and computer technology within a short time. The basic task of our publication is to aid teachers in its solution.

These words of Academician V.A. Melnikov, pronounced at a meeting of the editors with readers--the teachers of the Moscow Oblast--sounded like words to launch the new journal "Informatics and Education," the first issue of which recently appeared. It is published by the USSR Ministry of Education, the USSR State Committee on Professional and Technical Education and the USSR Ministry of Higher and Secondary Special Education. Two more issues will appear before the end of this year. In the future, readers will receive it every two months.

Almost 130 pages, each of which helps the teacher, the student, and the scientist--this is no insignificant size. The first issue opened with an article by the USSR Minister of Education S.G. Scherbakov and included the columns "General Questions," "Instruction Methods," "Computer Technology Classroom," "The Computer in the National Economy," "Foreign Experience," "Information Technology Dictionary" and others.

The journal broadly illuminates the issues of information technology teaching practice in schools, SPTU [Professional-Technical Secondary Schools] and technical high schools, and the questions of school classroom equipment and making the new technology operational. Programs for the school computers are not forgotten. Article authors give program descriptions and methods for using them.

The journal should become a reliable aid and faithful friend to the teacher and should also find its fans among parents and, of course, students.

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PERSONALITIES

SIXTIETH BIRTHDAY OF VLADIMIR MIKHAYLOVICH KUROCHKIN CELEBRATED

Moscow ZHURNAL VYCHISLITELNOY MATEMATIKI I MATEMATICHESKOY FIZIKI in Russian Vol 26, No 6, Jun 86 pp 803-804

[Anonymous article saluting the 60th birthday of a prominent Soviet information scientist]

[Text] June 1, 1986, is the 60th birthday of the prominent Soviet information scientist and head of the program systems division, Computer Center, USSR Academy of Sciences, Vladimir Mikhaylovich Kurochkin.

V.M. Kurochkin started his scientific career as a mathematician-algebraist in the mechanical-mathematical faculty of Moscow State University. He published a series of works on the theory of rings and algebras.

Since 1950, working in the Institute of Precise Mechanics and Computer Technology, USSR Academy of Sciences, V.M. Kurochkin has taken an active part in the development of a command system for the BESM, one of the first Soviet computers. For this work V.M. Kurochkin was awarded the Order of the Red Banner of Labor.

Later, V.M. Kurochkin was occupied with programming, at that time a new area of science.

In 1955 the Computer Center, USSR Academy of Sciences was created, and V.M. Kurochkin became head of the programming laboratory. In addition to works on automation of programming, the laboratory carried out important computer projects. Soon the laboratory became one of the programming centers in the USSR. In the following years several groups split off, forming the nuclei of other divisions in the Computer Center and also in other institutes (Computer Center, Siberian Section of the USSR Academy of Sciences and the Central Economic-Mathematical Institute).

V.M. Kurochkin became one of the first in the USSR to work on the automation of programming. In years when the reliability of the vacuum tube computer was extremely low, the possibilities of linking computers with the external world was at the level of a computational-analytical machine, V.M. Kurochkin headed work on the creation of a programming program, and as a consequence, the languages of programming and translators. The developers of these

programs had to struggle with colossal difficulties, and it was necessary to keep a clear perspective to overcome them.

Under the direction of V.M. Kurochkin the PPS translator was created for the Strela-3 computer, as was a translator from the ALGOL language for the BESM-2 computer. Following this, V.M. Kurochkin put together the original, widely-used "Compiler and Interpretive System" (CIS) for the BESM-2 computer.

V.M. Kurochkin made a large contribution to programming languages. He was an active participant in the international group on automation of programming which developed the language ALGAMS.

Under the direction of V.M. Kurochkin, at the Computer Center, a translator for the ALGOL 60 language was created for the BESM-6, which to this time remains one of the most important software components of this computer.

Work on translators naturally attracted the attention of V.M. Kurochkin to the automation of their development and to formalization of the description of programming languages. On the basis of this formalization, the apparatus of attributive grammars was proposed. The attributive grammars were generalized, permitting use of their greater effectiveness for defining the programming languages. V.M. Kurochkin proposed an original asynchronous computational algorithm for the semantic attributes.

Since 1948 V.M. Kurochkin has led pedagogical work in the Moscow Physical-Technical Institute. He developed university programs in computer software, linear programming and translation methods. Lectures by V.M. Kurochkin smoothly combine the mathematical bases of programming and practical achievements.

Many Soviet programming specialists consider themselves students of V.M. Kurochkin. People working alongside him know him not only as a specialist with exceptionally great prestige, but also as a sensitive and attentive person. Under his direction many dissertations were completed in the area of implementing programming languages and on the theory of programming.

V.M. Kurochkin is of great service in disseminating scientific knowledge. He has been a member of the editorial committee of our journal from the day it was founded, and editor and translator of several editions.

V.M. Kurochkin was at the foundation of Soviet programming and today continues active creative work.

We salute Vladimir Mikhaylovich Kurochkin on his 60th birthday and wish him excellent health and further creative successes.

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CONFERENCE ON AUTOMATIC CONTROL

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 20 Sep 86 p 3

[KazTAG report: "Scientists--To the Matter of Control"]

[Text] Every three years the USSR National Committee on Automatic Control, in conjunction with the leading scientific organizations of the country, holds an All-Union conference on problems of control in different branches of the economy. It is convened in the year preceding the regular congress of the International Federation on Automatic Control in order to present at it the most promising reports. Such a conference opened on September 29 in Alma-Ata. Here, more than 1,000 specialists from 70 cities of all the union republics represent the scientific-research institutes, association construction bureaus, factories, plants and institutions of higher education.

The text of the opening address of the organization committee chairman, Academician V.A. Trapeznikov, which Professor N.A. Kuznetsov read aloud, stated that fulfilling the program of intensive development and acceleration of scientific-technical progress adopted by the Party requires a more active introduction of science and a close cooperation between science and industrial enterprises. The president of the Kazakh SSR Academy of Sciences, M.A. Aitkhozhin, addressed greetings to the conference participants.

In the first place, for what kind of practical problems is it possible and necessary to achieve the largest impact. Which problems, given this, must be solved. Of the accumulated experience, what holds promise for the future; what has become obsolete. These and other questions will have to be decided.

The deputy chairman of the Kazakh SSR Council of Ministers, M.M. Akhmetov, the leaders of the Kazakh SSR Academy of Sciences and a number of ministries and departments of the republic and party and Soviet workers were present at the opening of the conference.

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Conference on Interactive Multi-Terminal System

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 20 Sep 86 p 3

[KazTAG report: "Interactive Session With a Computer"]

[Text] The process of computerizing management in a period of reorganizing the economy is playing an ever greater role. It allows specialists to dynamically analyze the production situation and to make prognoses on the development of events and to work out alternative operative solutions with an evaluation of their economic expediency. But, in the conditions which have arisen of creating large-scale processing centers, methods of working with computers are still labor-intensive, especially in programming and debugging the corresponding programs. This process takes an unjustifiable amount of time. And, most essentially, work with a computer requires the presence of highly qualified programmers while excluding, for all practical purposes, the possibility of on-line intervention by the user in the solution of one problem or another.

The republic conference-seminar "Experience of Applying the DIAMS Operating System in the Economy," which opened on September 29 in Alma-Ata, was dedicated to questions of more intensive utilization of computer intelligence. It was held by Gosstroy [State Committee for Construction Affairs], the Kazakh SSR Minmontazhspetsstroi [Ministry of Assembly and Special Construction Projects] and the republic governing board of the construction industry NTO [Scientific and Technical Society]. The speeches by Ye.G. Yezhikov-Babakhanov, the Kazakh SSR Minister of Assembly and Special Construction Projects, by G.P. Ostapenko, department head of an Institute of the USSR Minpribor [USSR Ministry of Instrument Making, Means of Automation, and Control Systems], and by others noted that the wide application of the interactive multi-terminal system (DIAMS) can promote a better utilization of a specific class of computers. Putting it into operation at the administration of the South-Kazakhstan "Kazkhimmontazh" trust has already yielded a positive result. The exchange of opinions at the seminar-conference will aid the development of an effective technical policy in the utilization of processing technology.

Specialists and scientists from a number of union republics took part in the work of the seminar-conference.

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